SCOPE

The information contained in this section is applicable to all suffixes of the SLT card Ground Rules covered by DEP 2-7047. These rules include all of the presently available information pertaining to the design and processing of card and card related documentation required for the internal Engineering, Laboratory to Laboratory, and Engineering to Manufacturing interface.

Below are listed the main subjects covered in DEP2-7047. These main subjects are called suffixes and to this date we have eleven (11). The titles for these suffixes are listed along with their contents. The suffixes are made up of various sections not indicated on the following list. Therefore, the main division of the DEP2-7047 is the Suffix, the division within the Suffix is the Section.

SUBJECTS COVERED IN DEP2-7047

Suffix	Title	Contents
0	Comprehensive SLT Card Ground Rule Information	Includes information that is applicable to all suffixes.
1	SLT Card Logic Diagram	Ground Rules for manual entry of the Card ALD into the automated system.
2	Specification and Circuit Flyer Preparation and Procedures	Ground Rules for originating and maintaining Circuit Flyer and Specifications.
3	Card Layout Ground Rules	Ground rules covering physical requirements for SLT card layout.
4	CCDA-CCRP Systems Requirements.	Ground rules for manual entry of cards into the CCDA automated system.
5	Component Availablity	Requirements for the justification and release of new components. This suffix is to be included at a later date.

Suffix	Title	Contents
6	Cable Cards	Ground Rules for the physical layout and processing of cable cards.
7	Special Cards	Ground Rules for the physical layout and processing of special cards. Requirements for processing special cards are being revised. These requirements are to be included in the near future.
8	Documentation and Procedures	Ground Rules for Release and Change processing of SLT cards.
9	SLT Card Rework	Defines the procedures required for processing rework instructions into Manufacturing.
10	Manufacturing Process Build and Test	Description of the manufacturing build and test flow.
11	Liaison Representatives and Information Lists	Description of Engineering liaison function and information lists used in the SLT information distribution system.

OBJECTIVES

The objectives of the "SLT Card Ground Rule" publication is to make available in one book all of the information required for card layout and processing.

DATE OF APPLICATION

Four weeks from the date that the Ground Rule revision is mailed, the date appearing at the bottom of each page, these Ground Rules will be enforced at Dept. 146 by the Change Analysis and Manufacturing Pre-Analysis groups. The exception to this would be World Trade locations where a six-week period will be enforced. These revisions are applicable to both Releases and Changes.

Emergency Ground Rule alterations(those requiring immediate notification by teletype followed by formal Ground Rule distribution) will be enforceable immediately unless otherwise noted. This type of Ground Rule alteration will be reserved for emergency situations only and their number will be kept to a minimum.

DEVIATION APPROVAL

Procedures for originating and implementing Ground Rule Deviations are controlled by Dept. 146, Endicott. Refer to Suffix 11.

AUTHORIZATION

These Ground Rules are approved by Dept. 146, Endicott.

SUPERSEDED DOCUMENTS

These Ground Rules will take precedence over all previously written Ground Rules. Existing Ground Rules items not covered in DEP 2-7047 will continue to be in effect.

DISTRIBUTION

Responsibility-

Endicott Standards, Dept 399, will be responsible for publishing and distributing these Ground Rules.

DISTRIBUTION (CONT'D)

Method-

Distribution will be made to individuals from master rosters located in Endicott. Refer to suffix 11.

When revisions to the ground rules are made, a complete section will be distributed.

Distribution will be made by individual Suffix. Recipients are therefore required to list each Suffix number they require except Suffix "0". Suffix "0" will be distributed to each recipient.

SCOPE

This instruction establishes the ground rules for SLT Card Logic Diagrams.

SLT Card Logic Diagrams are commonly referred to as "Card Flyers" and Card ALD's (Automated Logic Diagrams).

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TABLE OF CONTENTS (continued)

DESCRIPTION

A Card Logic Diagram depicts the functions and their interconnections which are packaged on a SLT card. In essence this diagram describes the electrical topology of a SLT Card.

Circuitry is represented by rectangular blocks symbolizing functions (either logical or non-logical) connected by lines representing circuit interconnections. These blocks must appear on the SLT Card Logic Diagram exactly as represented on a circuit flyer (See Suffix 2).

Sources of electrical signals (inputs) enters the diagram on the left and generated signals (outputs) exit to the right.

Supplemental information about the card is given at the bottom of the diagram page.

The SLT Card Logic Diagram is given the same part number as the card assembly drawing.

DEVIATIONS

. The ground rules stated in this instruction must be followed. Any deviations must be channeled through and approved by Department 306, Endicott.

USERS

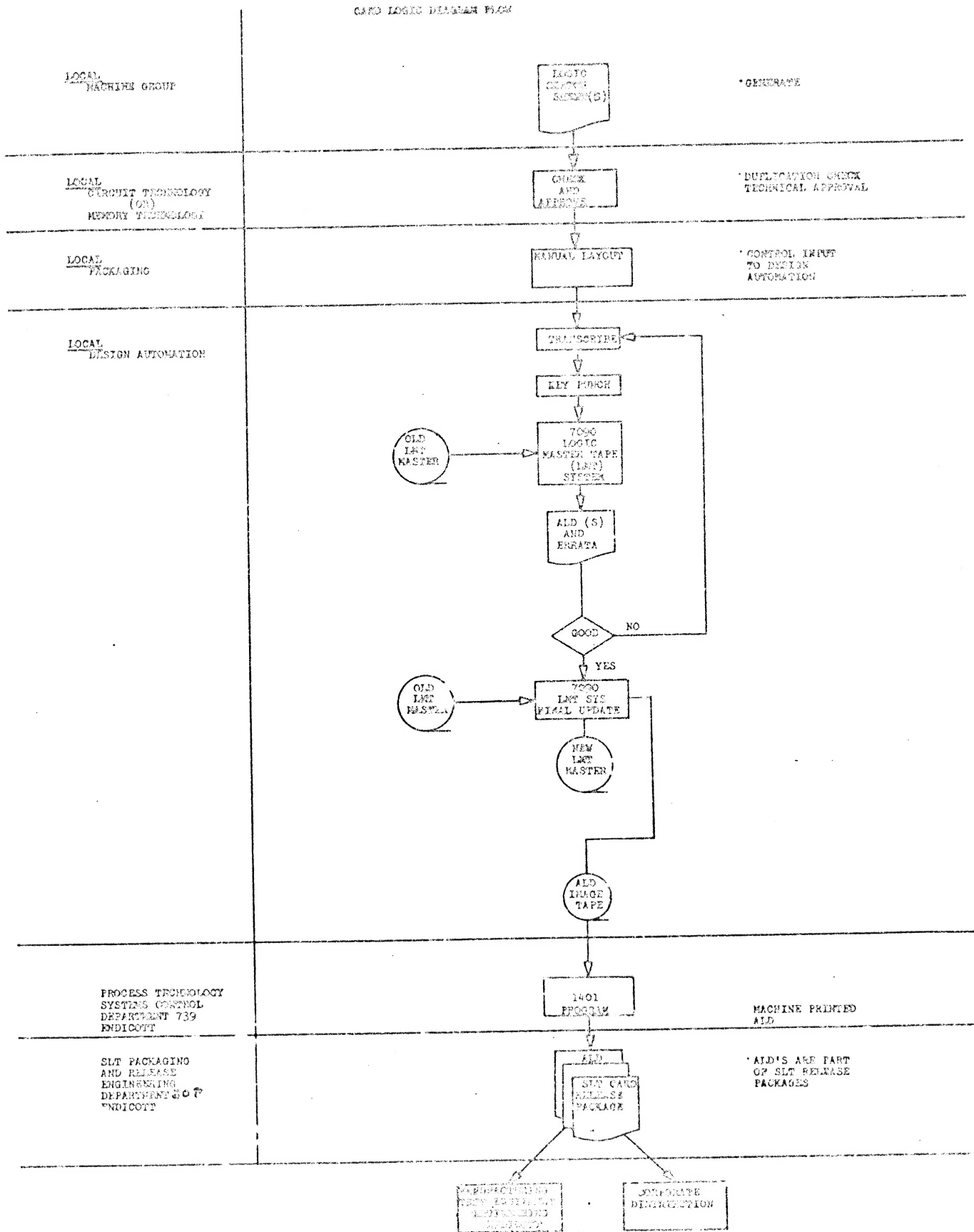
Circuit Technology - Duplication check.

Design Automation - As input to Circuit Card Design Automation (CCDA) automated placement and wiring programs.

As input to Solid Logic Design Automation (SLDA) Logic Master Tape (LMT) System.

Packaging - Communications link with requestor.

Test Equipment Engineering - Manual test generation and failure analysis.

Systems - Systems page generation and card definition to Circuit Technology.

LOGIC SKETCH SHEET

Form Number - 620-8171-1

INDEX	SECTION	PAGE
Auxiliary Title Fields	6	7-8
Block Identification Number	2	4
Block Title	2	8
Card Pins	2	8
Card Size	6	1
Card Specification	6	3
Change Level	6	4-6
Characterization Code	6	1
Comments Section	6	1-4
Common Inputs	5	1
Crossovers	3	3
Cross Referencing	4	3
Date	6	4
Decoupling	7	1
Designer's Name	6	4
Developmental	6	2
Division	6	6
Dot Blocks	5	2-3
E.C.	6	4-6
Edge of Block Character "K"	2	6-7
Edge of Block Character "N" and "P"	2	8
Edge of Block Character "X"	2	8
Edge of Block Content	2	5-8

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INDEX (CONTINUED)

INDEX (CONTINUED)

All logic block information except for card pin numbers and portion and sub-portion numbers are taken from the Circuit Flyer. Inputs and outputs are shown on the Card Logic Diagram (ALD) - inputs must not be used as outputs and vice-versa.

INDIVIDUAL LOGIC BLOCK AREA

The interior of the block is 6 characters wide (See Information Inside The Block, Page3).

There are two edge of box positions; 1 character each for edge of block characters. (See Information In The Edge Of The Block, Page5).

There are fields at either side of the block for 3 character card pin designations (See Information Outside the Block, Page8).

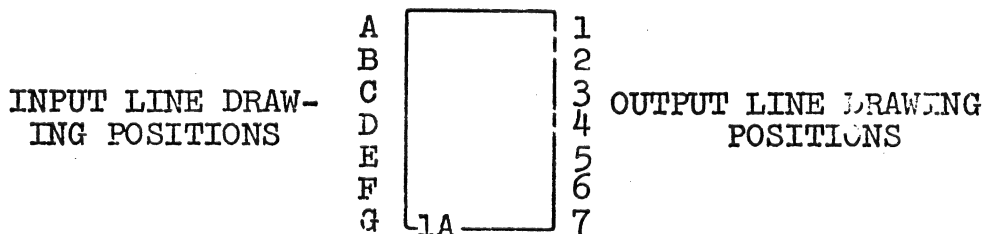
Five lines appear inside the block and one line on its bottom edge for block print position and block serial number. (See Information In The Edge Of The Block, Page 5).

The line immediately above the block has 14 characters available for the Circuit Specification part number. (See Suffix 2 and Information Outside The Block, Page 8).

LOGIC BLOCK SIZES

The logic block may be a minimum of 7 line positions high. With this size there are 7 positions for input lines, lettered A-G, and 7 positions for output lines, numbered 1-7. Proper line drawing positions are obtained from the circuit flyer (See Suffix 2).

EXAMPLE OF MINIMUM SIZE BLOCK:

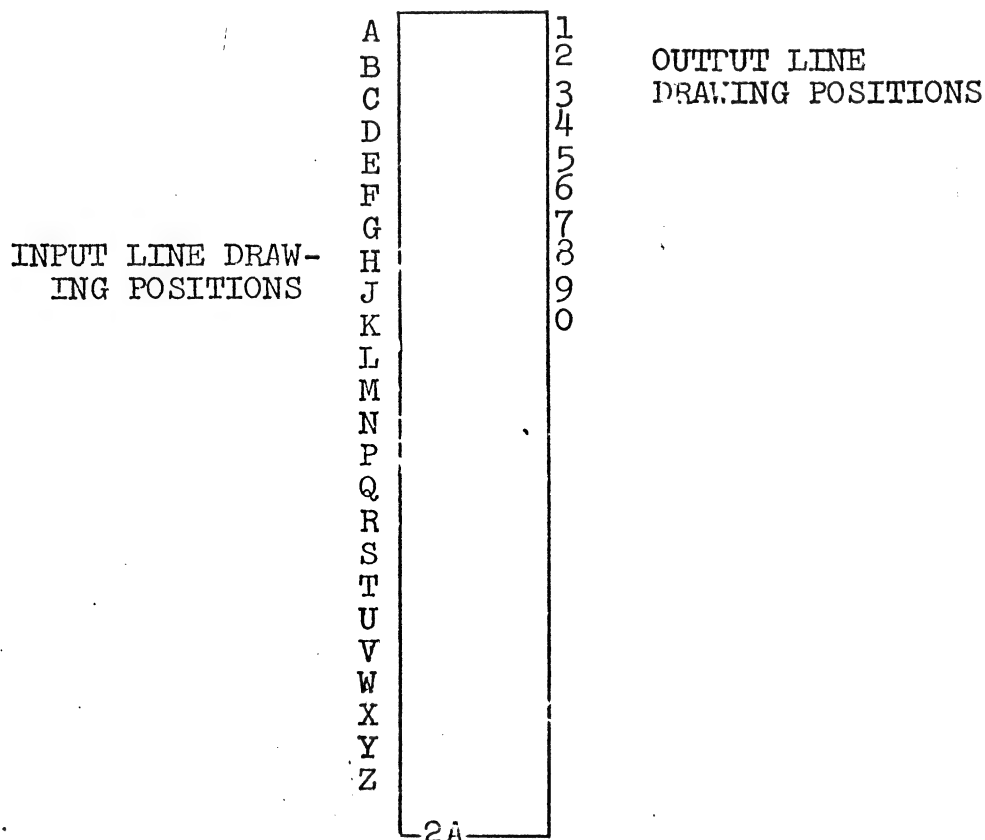
```
                              A ┌──────┐ 1
                              B │      │ 2
INPUT LINE DRAW-              C │      │ 3  OUTPUT LINE DRAWING
ING POSITIONS                 D │      │ 4       POSITIONS
                              E │      │ 5
                              F │      │ 6
                              G └1A────┘ 7
```

LOGIC BLOCK SIZES (continued)

When necessary, the block may be lengthened downward to accomodate additional input and/or output lines. The maximum number of input (sink) line drawing positions is 24, lettered A-Z, excluding I and O. The maximum number of output (source) line drawing positions is 10, numbered 1-9, 0.

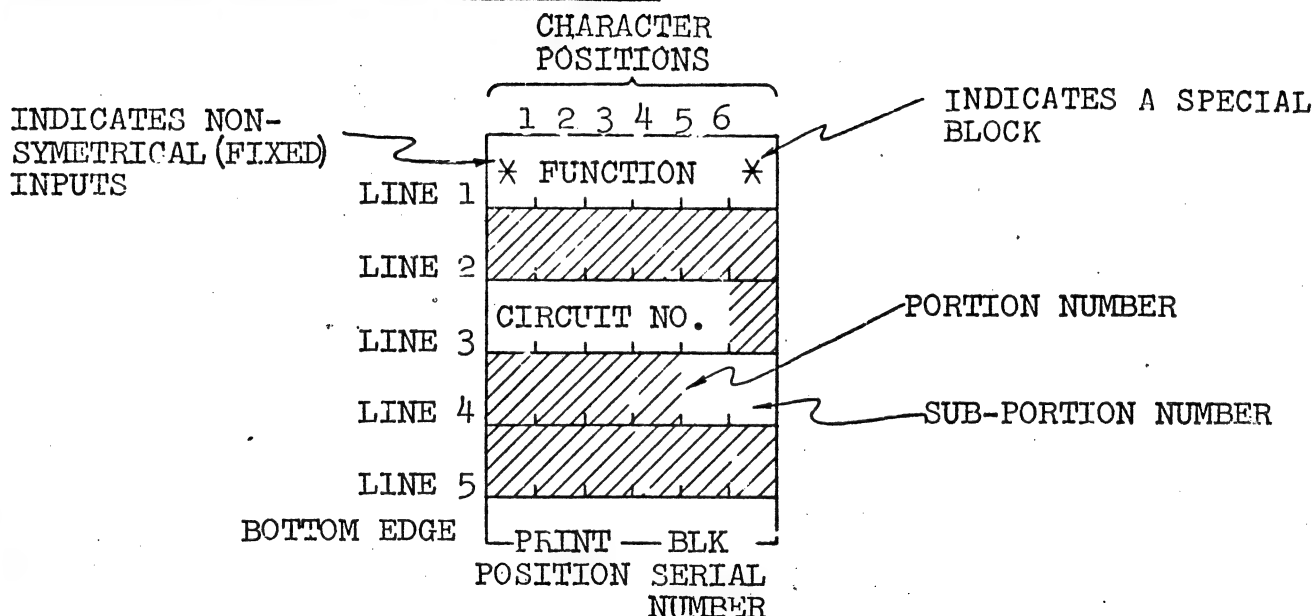
EXAMPLE OF MAXIMUM LENGTHENED BLOCK:

INPUT LINE DRAWING POSITIONS: A B C D E F G H J K L M N P Q R S T U V W X Y Z

OUTTUT LINE DRAWING POSITIONS: 1 2 3 4 5 6 7 8 9 0

2A

Blocks may not be lengthened below the bottom edge of the minimum sized blocks in row N (See Logic Sketch Sheet, Section 1, Page 1).

Lengthened blocks are assigned the block print position of the uppermost part of the block.

INFORMATION INSIDE THE LOGIC BLOCK

Line One - Characters 1-6, will include the function performed by the circuit. Permissible function symbols for a given circuit appear on the circuit flyer (See Suffix 2).

Exceptions to the function symbols indicated on the circuit flyer are for logic blocks with single inputs.

Block Type	Acceptable Function Symbology
Inverting Block	N, AR
Non-inverting Block	AR, A, OR

When input line positions are fixed due to non-symmetrical inputs, an asterisk (*) must occupy the first character position, and input line drawing positions must be specified (See Section 3, Page 3).

An asterisk (*) in line one character position one, and input line drawing position (s) must be specified for all logic blocks which are not defined as standard in the Packaging and Checking System. See CEP 0-2815, Suffix 5, page 2 and 3 for all blocks which are considered standard.

An asterisk (*) in the last character position of the logic block function field signifies a special block. When an asterisk occupies this field, the first character of this field must contain a blank (=) or an asterisk. In this case, the function symbol may only occupy characters 2-5. Permissible special blocks are:

1. Service Blocks - Function symbol SERV. This block must only be used for indicating a service voltage and may never have related components.

INFORMATION INSIDE THE LOGIC BLOCK (continued)

Line One (continued)

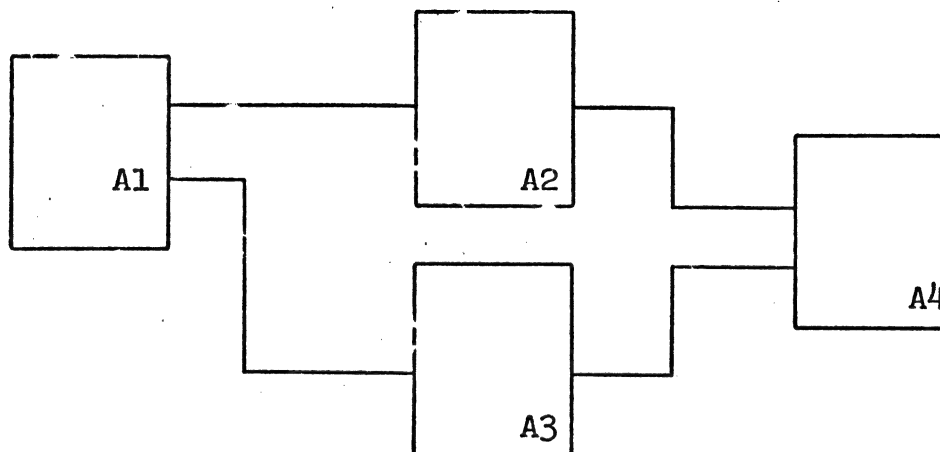
2. Entry Block - Functional symbol ENTR. This block is used when an input to a logic block on a given ALD page is also an input to another logic block on another ALD page, of the same assembly part number. See Common Inputs, Section 5, Page 1 for further explanation.

Line Two - is always blank (not used with Card Logic Diagrams).

Line Three - characters 1-5, contain the circuit flyer block identification number (see Suffix 2 for the block identification format); character 6 is unused.

Line Four - Characters 1-4, are always blank; characters 5 and 6 contain the logic portion and sub-portion numbers.

The portion and sub-portion number is two characters. The first character indicates an independent portion of logic (logic blocks tied together in any manner) and is unique to that portion. The second character indicates a sub-portion of the independent logic.

Example:

Each independent logic portion which may consist of 1 or up to 99 blocks must have a unique portion number (first character).

INFORMATION INSIDE THE LOGIC BLOCK (continued)

Line Four (continued)

Independent portions of logic which do not exceed 32 blocks will use the following format:

AN (A - alphabetic, N - numeric) with N from 1-9, and AA (A - alphabetic) with the second alphabetic character from A-Z excluding I, O, and R. <u>Exception</u> - "R" may be used on resistor block.

Example: A1, A2, A3, ...A9, AA, AB, AC, AD, ...AZ (excluding AI, AO, and AR with the exception that "AR" may be used with a resistor block).

Independent portions of logic which exceed 32 blocks will use the following format:

NN (N - numeric) with NN from 01 - 99.

When an independent portion of logic exceeds 99 blocks, contact your Design Automation representative.

<u>Line Five</u> - Is always blank (not used with Card Logic Diagrams).

<u>INFORMATION IN THE EDGE OF THE BLOCK</u>

<u>Bottom Line</u> - characters 1 and 2 are used for the block print position. The print position is indicated on the logic sketch sheet in light blue and must be traced over, in black pencil, in order that reproductions may be made. The print position indicates to the ALD drawing program the position in which to draw the block.

Characters 3 and 4 are part of the bottom edge line of the block and are not used for information purposes.

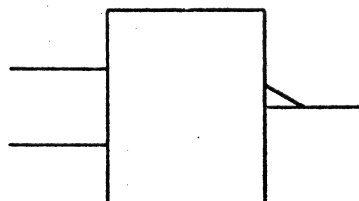
Characters 5 and 6 are used for the block serial number. The block serial number is a two letter unique designation of a block on a given ALD page. Block serial numbers are assigned for the blocks on each page in serial order beginning with AA. Since a given ALD page is restricted to approximately 49 logic blocks, this field is not limiting; however, characters beyond JZ must not be used.

The serial number has nothing to do with position; therefore, the block serial number does not change when changing block position as long as the block is not moved to another ALD sheet.

INFORMATION IN THE EDGE OF THE BLOCK (continued)

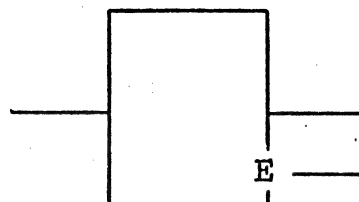
Edge Of Block Characters

Wedge - A wedge in the edge of a block in line with an input or output line indicates that the more negative of two DC voltages may be expected at the indicated input or output line when the circuit represented is performing the indicated function. The absence of a wedge indicates that the more positive voltage may be expected.

Example:

Test Points - (See Suffix 2, Section 25).

Extend ("E") - An "E" must be placed in the right edge of a logic block when its inputs are extended.

Example:

E

The "E" edge of block character is always recognized, by the programs, as the source of a net. Also see use of the edge of block character "K," below.

Edge Of Block Character "K" - must be inserted in the right edge line of a logic block which is extending. The "K" edge of block character is always recognized, by the programs, as the sink of the net.

INFORMATION IN THE EDGE OF THE BLOCK (continued)

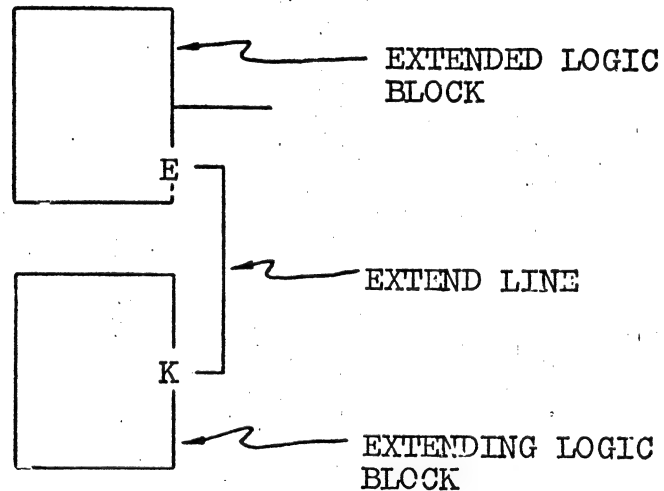
Example:

EXTENDED LOGIC BLOCK

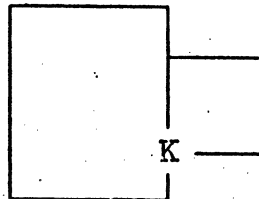
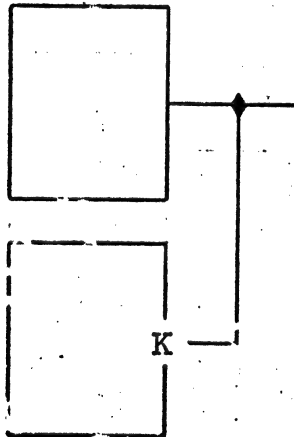
E

EXTEND LINE

K

EXTENDING LOGIC BLOCK

Non-Logical Outputs - of the same block or different blocks may be tied together. All of the common outputs except one which is determined the source must contain the edge of block character "K" in line with the non-logical output. This is done so that the Design Automation program sees only one source per net.

Example of common outputs on a single block.

K

Example of common outputs of different logic blocks.

K

INFORMATION IN THE EDGE OF THE BLOCK (continued)

Edge of Block Characters "N" and "P"-

N - Used to indicate negative-going shift when an input is AC coupled.

P - Used to indicate positive-going shift when an input is AC coupled.

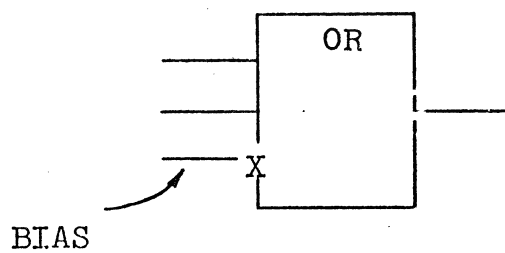
For further explanation of these edges of block characters, see Corporate Engineering Standard 0-1046-3.

Edge of Block Character "X" - is used to indicate non-logical connections to a logic block. Examples of non-logical connections are: voltage, bias. feed back, shield lines and other connections shown at the block but which do not affect the logic function of the block.

Example:

OR

X

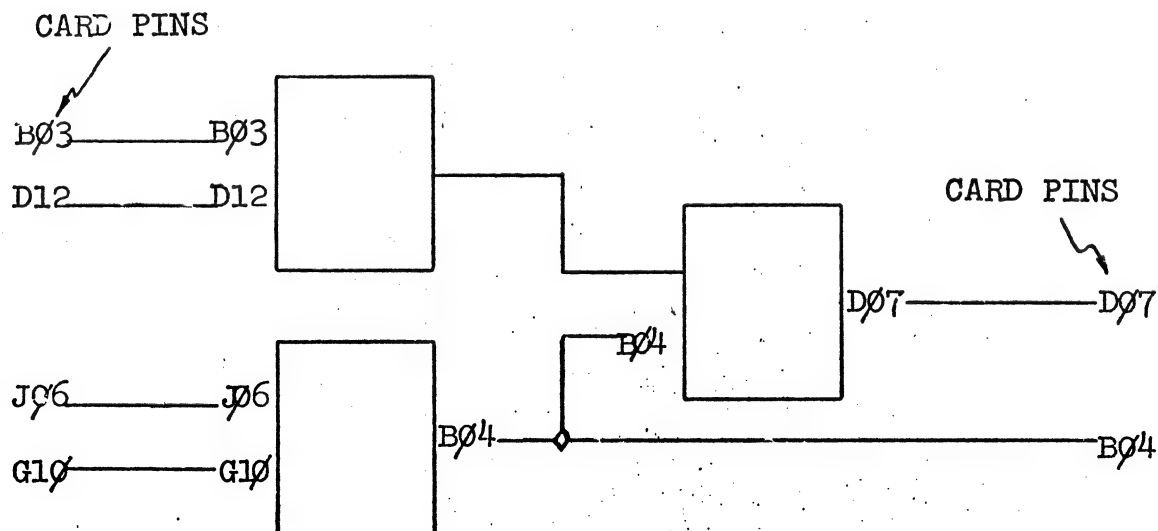
BIAS

INFORMATION OUTSIDE THE BLOCK

Fourteen spaces are available in the line immediately above the block field when it isn't occupied by another block. On Experimental Released cards this field may contain a block title, circuit delay, or applicable notes.

Specification Number - When the card is Development or Formal Released, the Circuit Specification part number must be indicated once for each different circuit flyer Block.

This Circuit Specification part number will be placed in the 6 character positions directly above the logic block field. Another logic block must not be drawn in the block drawing position directly above the block requiring the specification number.

Card Pins - must appear at the left and right of logic blocks which have input and output lines that go to card pins or are in nets that go to card pins. There are three character positions adjacent to each line drawing position for this purpose.

INFORMATION OUTSIDE THE BLOCK (continued)

Example:

CARD PINS

BØ3 — BØ3
D12 — D12

CARD PINS

DØ7 — DØ7

BØ4

JØ6 — JØ6
G1Ø — G1Ø

BØ4 — BØ4

Logic Sketch Sheets are manually drawn as input to Design Automation programs to obtain checking and computer drawn documents Automated Logic Diagrams (ALD).

LOGIC BLOCK POSITIONING

Logic Blocks are positioned in a matrix 7 columns wide and 13 rows high. The columns are numbered 1-7; the rows are lettered A-N, excluding I; the 91 block positions are labeled 1A through 7N. The need for routing lines across a page restricts the number of block positions which may be used to 49 under average conditions.

Thirteen blocks may be drawn in one column only if no wiring is required between logic blocks in this row (See Routing Space below).

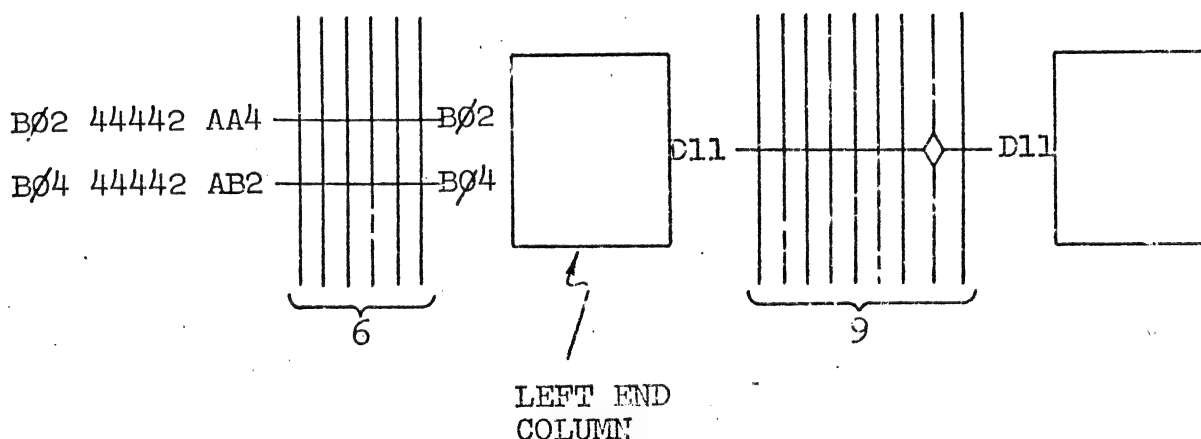
LINE ROUTING SPACE

All line routing and positioning is computed by the program. In order that the routing limitations are not excluded the following rules must be followed:

Input and Output Lines - Ninety one (91) positions are available at either side of the logic sketch sheet for input and output lines.

Vertical Routing - A maximum of 9 lines are available for vertical routing between horizontally adjacent blocks. A maximum of 6 lines are available for vertical routing between blocks in end columns and the information on input and output lines.

Example:

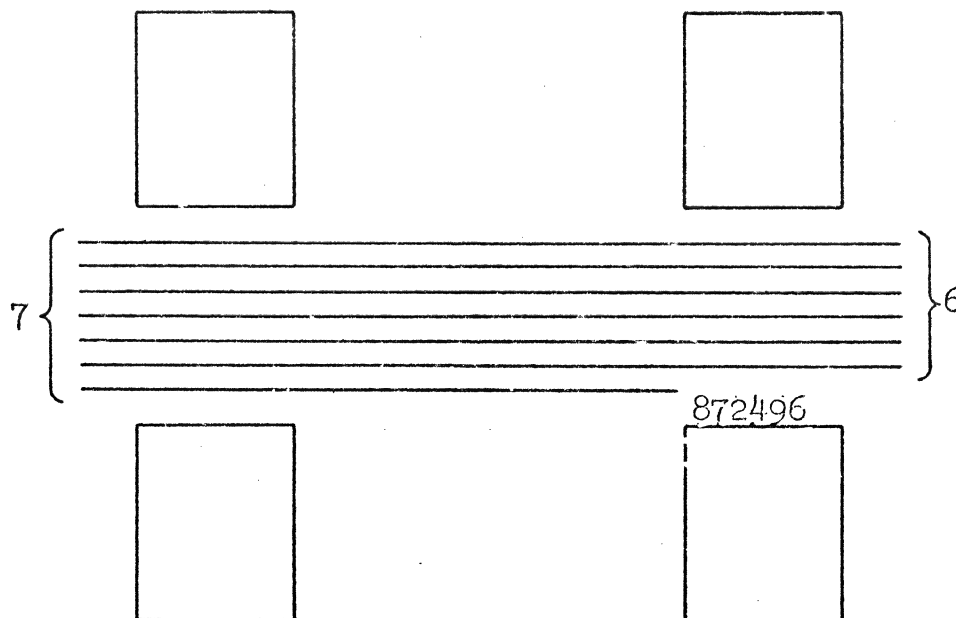
B02 44442 AA4 — B02
B04 44442 AB2 — B04
D11 — D11
6
9
LEFT END COLUMN

LINE ROUTING SPACE (continued)

Horizontal Routing - Seven lines are available for horizontal routing between blocks separated vertically by one block position. The limit is six lines if the lower block has a specification part number, block title, or other information in the line directly above the block.

Example:

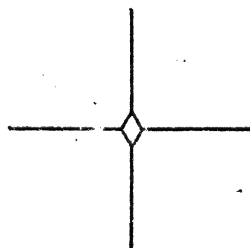
7

6

872496

No lines may be routed horizontally between vertically adjacent block drawing position if they contain blocks.

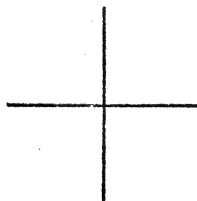
Lines cannot be routed past a column of thirteen blocks, or above blocks in row A, or below blocks in row N (See Logic Sketch Sheet, Section 1, Page 1)

JUNCTIONS AND CROSSOVERS

Junctions - are shown by placing a diamond at the point of intersection.

Example

JUNCTIONS AND CROSSOVERS (continued)

Crossovers - are indicated by the absence of a diamond at the point of intersection.

Example:

LINE DRAWING POSITIONS

Fixed (Non-Symmetrical) Inputs - must have line drawing positions indicated in addition to an asterisk (*) in line one character position one of the logic block (See line One information, section 2, page 3). Symmetrical inputs need not have line drawing positions indicated. See Circuit Flyers, suffix 1 for line drawing positions when inputs are fixed.

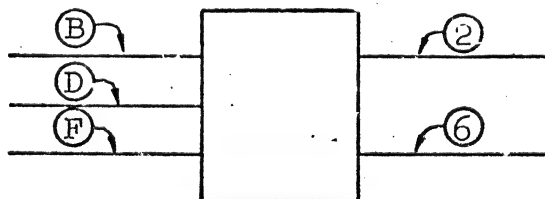
Singular Output - line drawing positions must not be indicated unless they are desired to be other than output line drawing position 4. Output line drawing position 4 is automatically used unless otherwise specified.

Multiple Output - line drawing positions must always be specified. See Circuit Flyer for line drawing position.

Line Drawing Position Indication - is accomplished by writing the letter or number of the desired line position near the block and line. The letter or number must be circled with an arrow drawn from the circle to the line. See Logic Block Sizes section 2, pages 1 and 2 for all possible line drawing positions.

Rule: Inputs-Alphabetic; Outputs-Numeric

Example:

B
D
F
2
6

All inputs to logic blocks must come into the left side of the page and all outputs to logic blocks must leave the right side of the page.

LINE NAME

A 30 character field is available to accomodate card pin designations and line names for both inputs and outputs in a given ALD page.

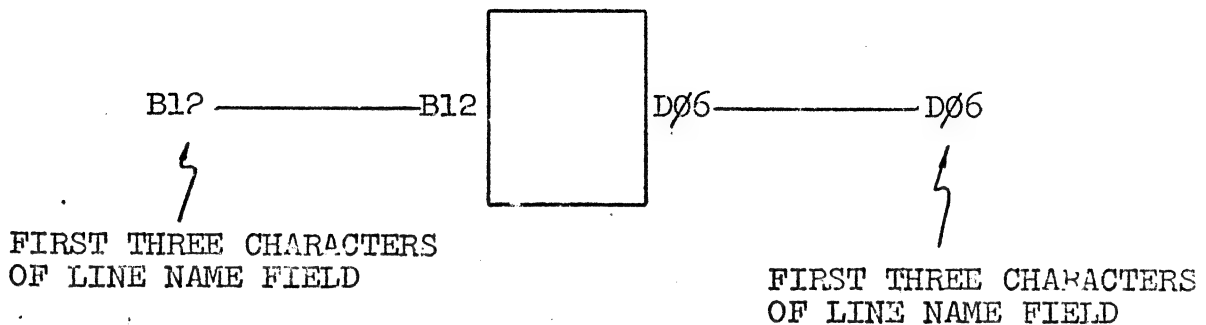
The first three character positions are reserved for the card pin number, the fourth character must be blank (= is used to indicate blank space) and the remaining 26 characters may contain a line name.

The line name field must always contain a card pin number unless the line in question is going to or coming from another ALD page without being connected to a card pin.

EXAMPLE:

B12 ———— B12 [ ] DØ6 ———— DØ6

FIRST THREE CHARACTERS OF LINE NAME FIELD

FIRST THREE CHARACTERS OF LINE NAME FIELD

LINE NAME (continued)

For the case where the line is only connecting ALD pages, without going to a card pin a line name must be inserted starting at character position 5 preceded by 4 blank spaces.

EXAMPLE:

CHARACTER POSITION 5 OF THE LINE NAME FIELD

BLOCK SERIAL NUMBER

AA

16242====LOGIC 2

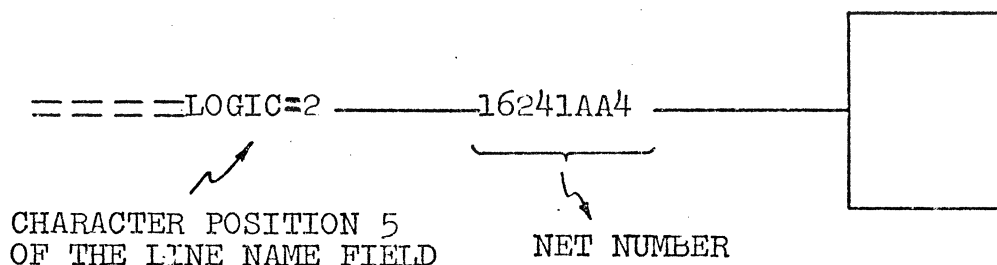
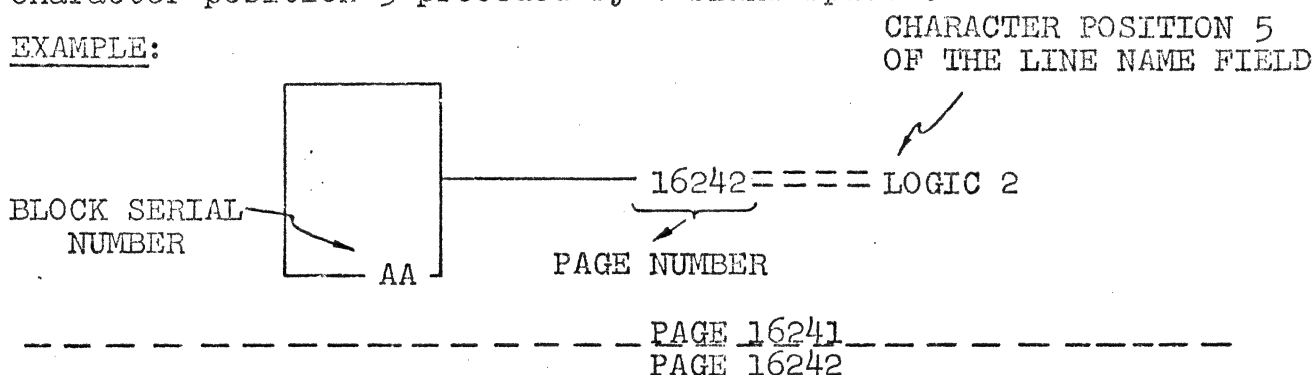
PAGE NUMBER

PAGE 16241

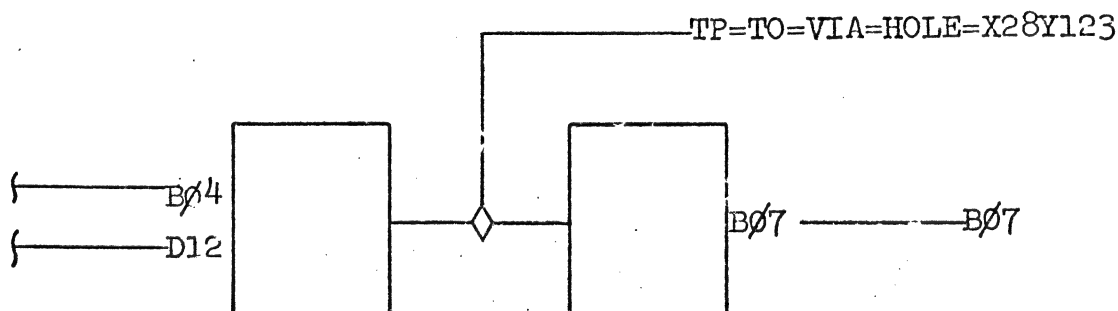
PAGE 16242

====LOGIC=2 16241AA4

CHARACTER POSITION 5 OF THE LINE NAME FIELD

NET NUMBER

Test points must be shown as outputs and indicated by placing the letters TP and other applicable information in regard to the test point in the line name field after the pin number designations.

In the case where a test point is connected to a via hole at the top of a card it must be shown as an output and the x-y coordinates of the via hole and other applicable information indicated.

EXAMPLE:

TP=TO=VIA=HOLE=X28Y123

BØ4

D12

BØ7 BØ7

NET NUMBER

Net numbers must be inserted in the indicated space when an input to a given ALD page is coming from an output on another page (see first example on page 2).otherwise it should be blank.

The net number is 8 characters in the form NNNNNAAN. (A-Alphabetic; N-Numeric). The first five characters are the page number of the page where the input line originated, the sixth and seventh characters are the block serial number of the block where the input line originated and the last character is the output line drawing position of the block where the input line originated.

When non-logical outputs are tied together on the same blank, the Net number will indicate the line origin of the line without the "K" edge of block character. (See section 2, page 7)

When non-logical outputs of two different blocks are tied together, the Net number will include the line origin of the line from the block method the "K" edge of block character. (See section 2, page 7)

PAGE NUMBER

Page number must be inserted in the indicated space on the logic sketch sheet in line with the output line when it is going to another ALD page (see second example under line name, page 2). This space will be left blank when the output doesn't go to another ALD page.

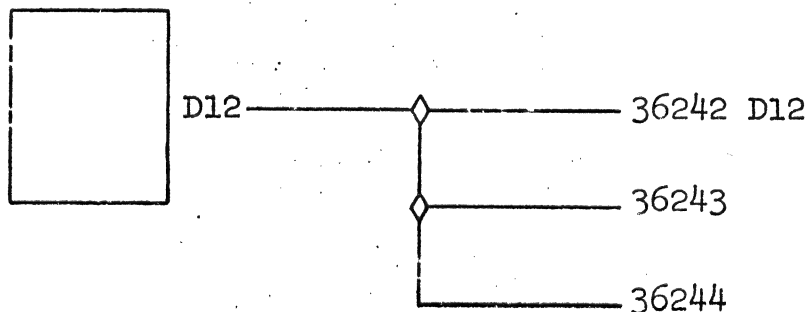
This page number is the page number of the page which the output line is going to. It is 5 character positions in the form NNNNN (N-Numeric).

When an output line goes to more than one ALD page each of these pages must be indicated. If it is also tied to a card pin, the card pin need only be indicated once.

Example:

D12 —— 36242 D12

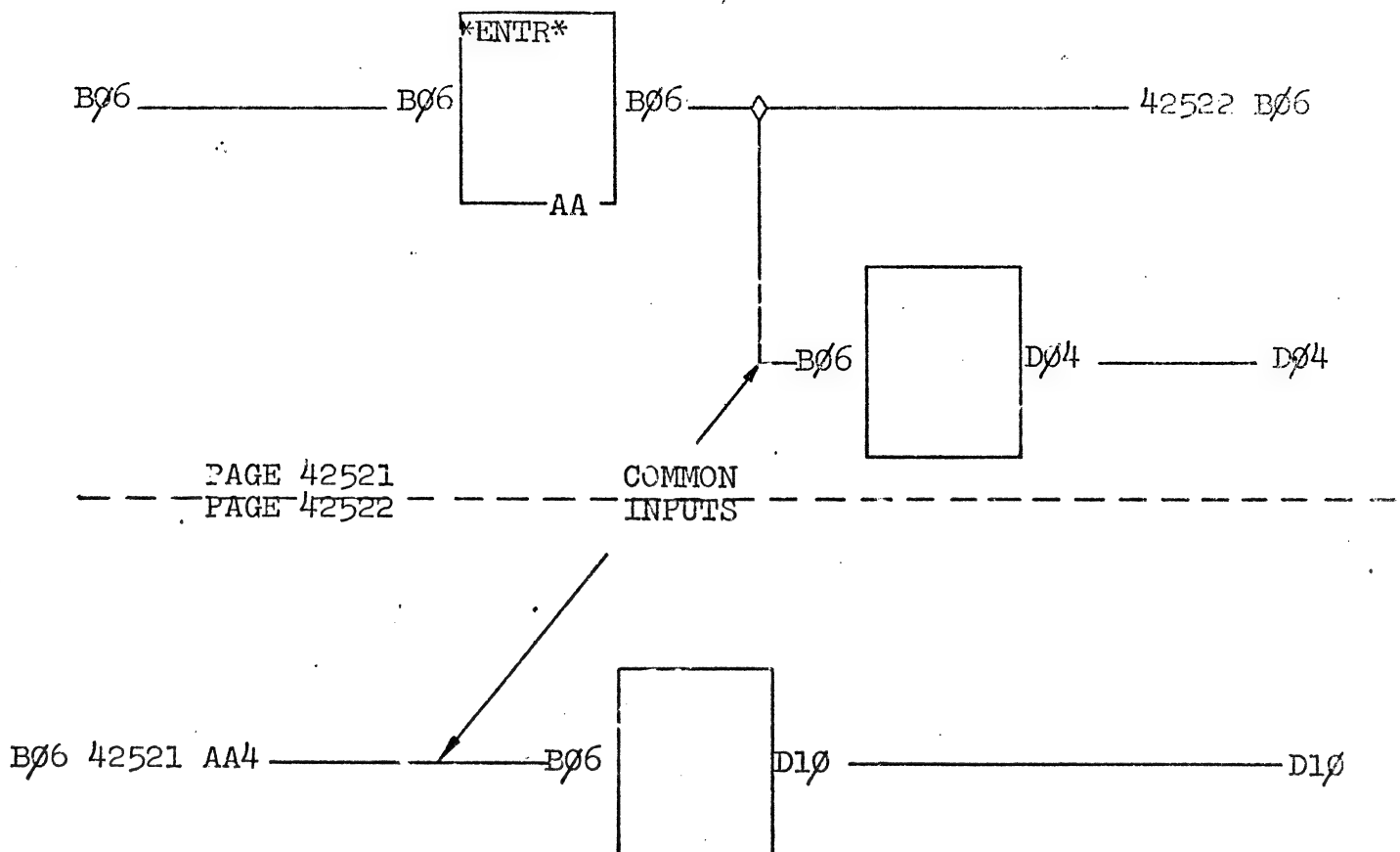
36243

36244

COMMON INPUTS

When an input, to two or more logic block on different ALD pages of the same part number, is common an entry block is required on the first page that uses this input. The logic function for an entry block is "ENTR".

Pin number designations for ENTR blocks are the same at both input and output.

Maximum number of inputs and outputs to an ENTR block is 10.

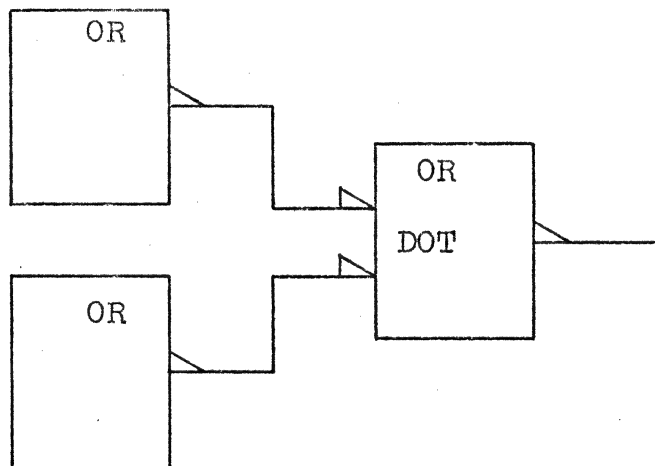
EXAMPLE:

DOT BLOCKS

Two or more logic outputs cannot go to the same input. In order to eliminate such a condition, the Dot Block is used.

Example:

OR

OR
DOT

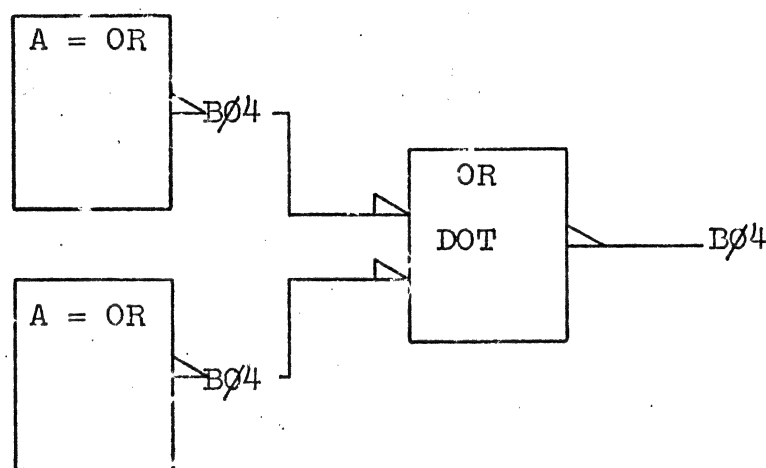
OR

The function performed at the Dot Block (A or OR) must be identified in the logic function field of the Dot Block and the letters DOT must be inserted in line three (where the circuit flyer block identification number would normally appear.

$ The primary block function symbol of each of the basic function blocks must be followed by a blank (=) and the logic function symbol (A or OR) of the Dot Block. See example above and below. This is required so that a dotting condition is evident when the dot block is not on the same page as the prime blocks.

EXAMPLE:

A = OR
BØ4

OR
DOT
BØ4

A = OR
BØ4

It is manditory that the wedge is used at both input and output of the dot block when the outputs of the blocks feeding the dot block have wedges (See example above).

DOT BLOCKS (continued)

When an output of a Dot block terminates at a card pin, the card pin number may or may not be inserted beside the Dot block in line with the input and output lines, depending on designers needs. However, if the card pin number is used it must be inserted with both the input and output lines of the Dot block. In any case the card pins number must be placed beside the blocks feeding the Dot block in line with their outputs (see second example on previous page).

An input to a Dot block may never originate at a card pin.

The sources of all the inputs to a dot block must be located on the same card as the dot block.

Branches on lines feeding dot blocks are not permitted.

One dot block may never drive another dot block.

Endicott - Department 306

April 22, 1967

MEMO TO:

W. Behringer-Raleigh
L. Borgh-Sweden
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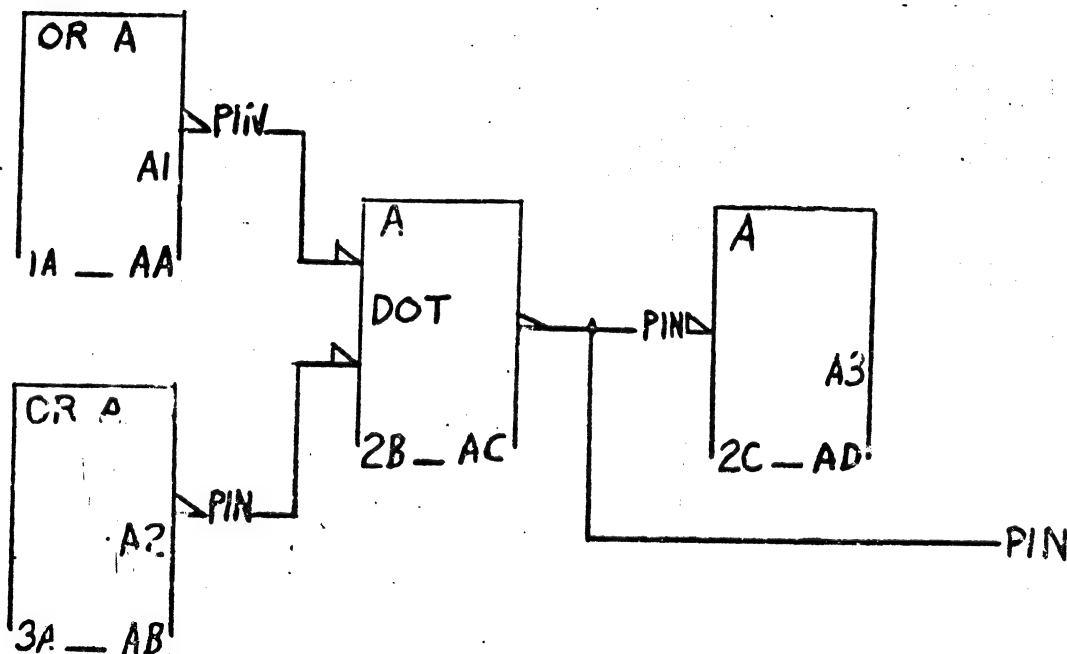
SUBJECT: Card Logic Diagram Rules

REFERENCE: SLT Card Ground Rules DEP 2-7047-001
Design Automation Standard CES 0-1046-003

The contents of this memo is to be used as an aid in processing card logic diagrams until the information can be put in the SLT Card Ground Rules DEP 2-7047, Suffix 1.

This memo is to clarify the use of DOT Blocks on logic diagrams as defined in Section 5 of Suffix 1 of the SLT Card Ground Rules. Also, blocks used in special applications will be clarified and the use of "Mumzer" for coding portion-subportions on logic diagrams is defined.

DOT BLOCKS

DOT Blocks must be used on card ALD's to connect two or more outputs of logic blocks together. For example:

In general (as shown in the previous example):

a) A DOT Block must contain the function symbol ("A" or "OR") of the function performed at the DOT.

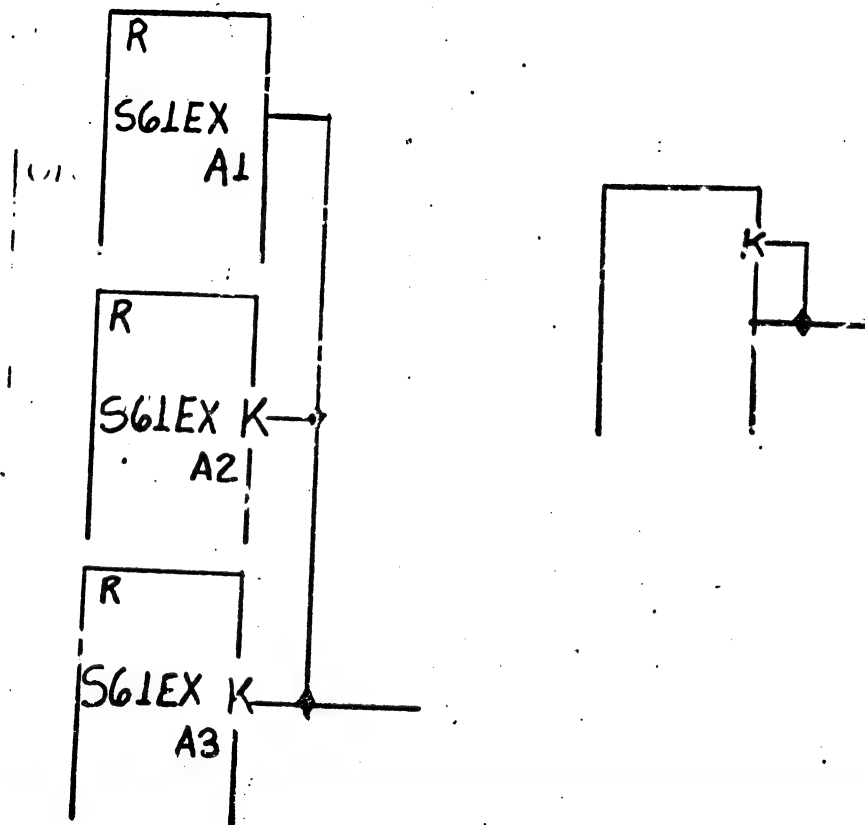
b) The letters "DOT" must appear in line three character positions 1, 2, 3 inside the DOT Block.

c) the DOT Block does not have a portion-subportion number.

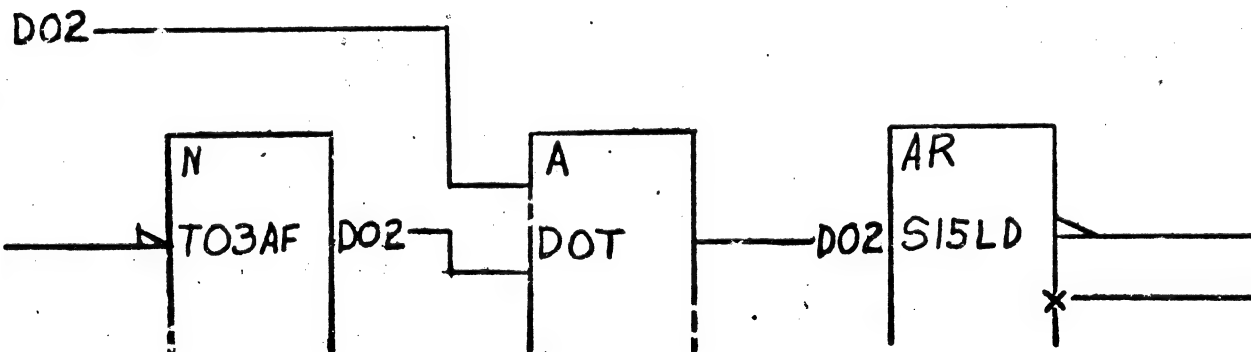
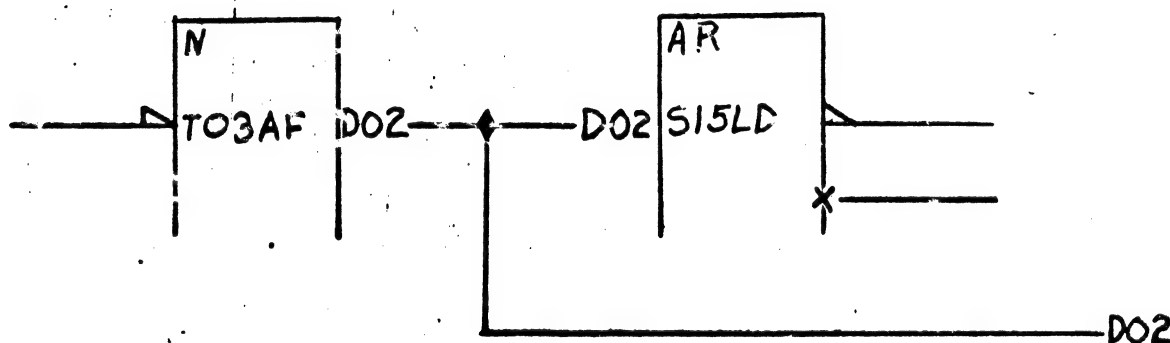
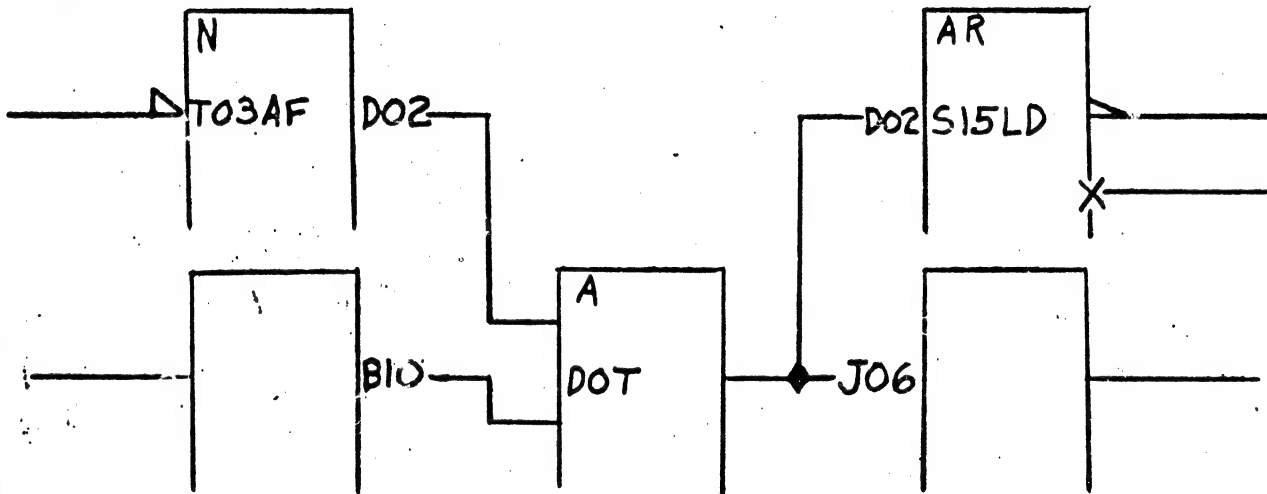
d) When outputs feeding a DOT Block have wedges, the inputs and outputs of the DOT Block must also have wedges.

e) The two blocks feeding the DOT Block must show their normal function in line one inside its block followed by a space and the function of the DOT Block.

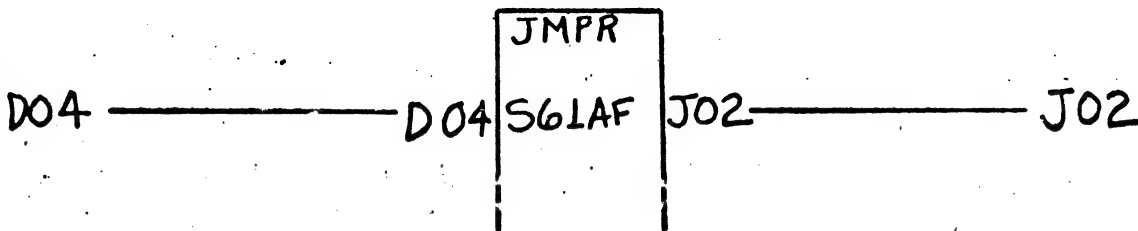
f) If the output of a DOT Block terminates at a card pin, the pin must be shown beside all blocks connected together by the DOT Block. The pin may or may not be shown beside the inputs and outputs of the DOT Block depending on the designers needs. However, it is preferred that the pins be shown as in the previous example.

g) DOT Blocks may only be used to tie logical outputs together. Non-logical outputs are tied together using a K as an edge of block character on the output of all blocks except the one designated at the source of the net. For example:

h) One DOT Block may never drive another DOT Block.

i) Branches on lines feeding DOT Blocks are not permitted.

j) An input to a DOT Block on a card page may never originate at a card pin (ie., there is nothing shown on the card being dotted together.) For Example - Illegal Condition:

The above illegal condition must be represented on a card page as:

The previous illegal condition is to be represented on a <u>system page</u> as:

JUMPER BLOCKS

Card Logic Diagram Representation

A "Jumper" block is used to "common" two card tabs (a line will actually connect one tab to another tab on the artwork).

Schematic Representation of Jumper

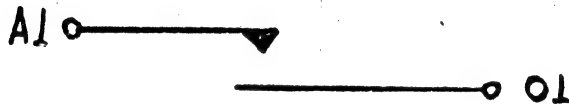
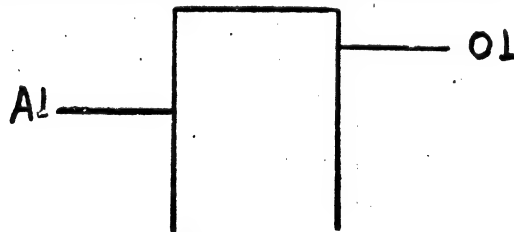
RELAYS*

Normally Open

Schematic Representation

A1 O1

Logic Block Representation

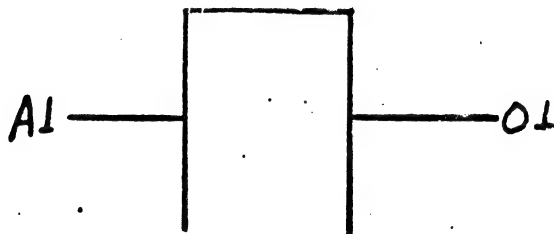
O1
A1

Note - output line is above input line

Normally Closed

Schematic Representation

A1 O1

Logic Block Representation

A1 O1

Note: output line is opposite input line

* Ref. CES 0-1046-003

ENTR Blocks

Exactly as defined in SLT Ground Rules DEP 2-7047, Suffix 1, Section 5.

EXTENDERS

Exactly as defined in SLT Ground Rules DEP 2-7047, Suffix 1, Section 5.

INTEGRATED CIRCUITS

The following is an example of the way an Integrated Circuit must be coded on an ALD so that the LTDS Program can handle it automatically.

EXAMPLE:

Group Code

Unique Block Identifier

*A
A
U20ABA
A1
N
1A AA

*A
A
U20ABB
A2
N
1C AB

FF
A
U20AAC
A3
2B AC

GROUP CODE

The Group Code is an alpha character associated with one integrated circuit that is posted in the first position of line two of all the related blocks. The Group Code will be different for every integrated circuit used on any one card ALD.

UNIQUE BLOCK IDENTIFIER

Each block in an integrated circuit is uniquely identified by an alpha character posted in the sixth position of line three. The unique block identifier is obtained from the design automation block representation portion of the circuit flyer. The blocks are identified alphabetically eith the left-most, upper-most block being identified ad "A" and proceeding top to bottom, left to right.

COMBINED FLYERS

Combined Flyers as defined in Section 23 of Suffix 2 are to be coded as follows:

Place an asterisk in line 3, position 6.

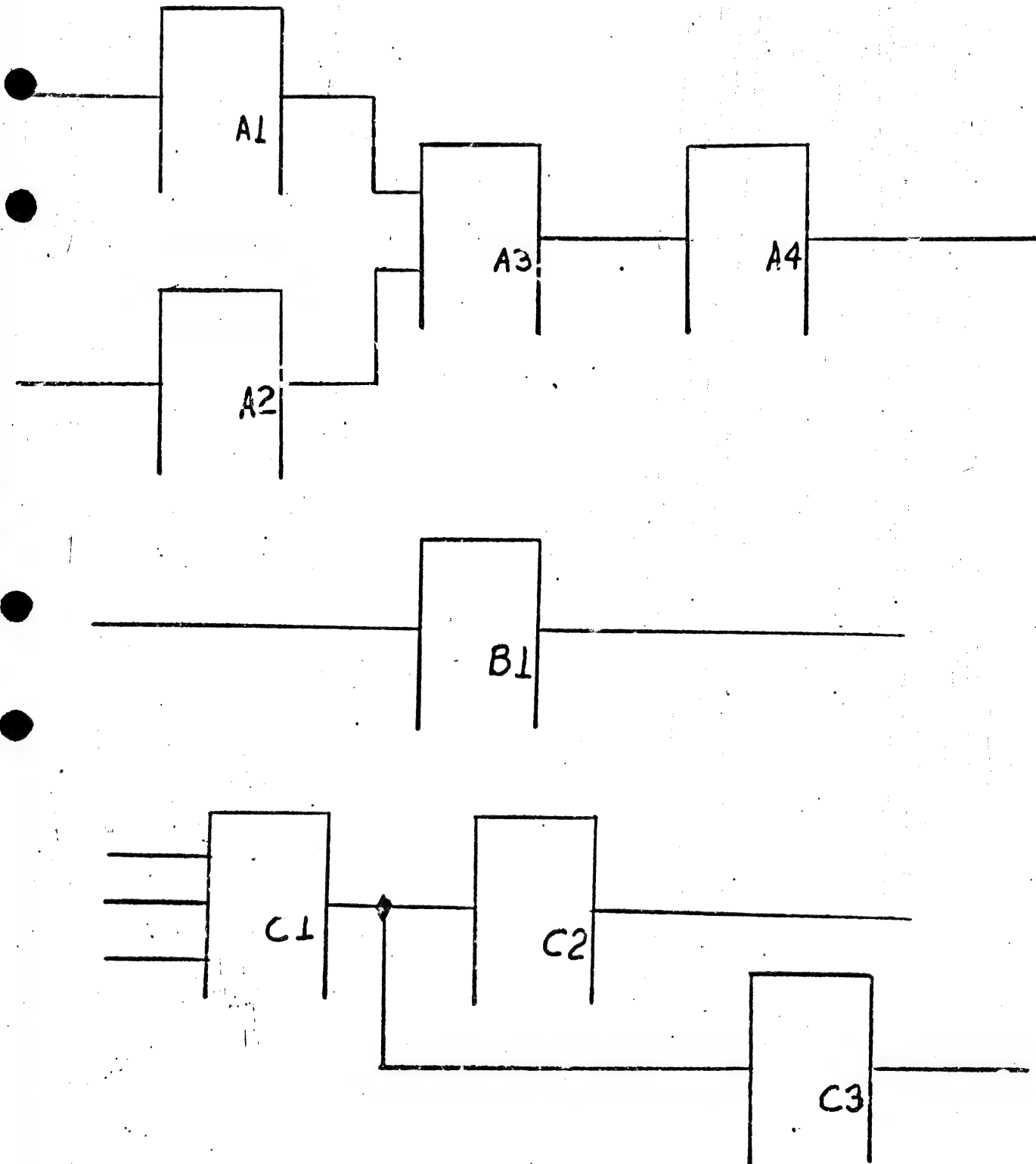
Example:

A
V03AK*
A1
1A
AA
(4)
(7)

Portion-subportion Coding

(See Suffix 1, Section 2 of the SLT Card Ground Rules for definition)

The portion-subportion code appears in line 4, character position5, 6 of the logic block. The portion-subportion code is used to identify all blocks common to a particular net.

Example:

Types of Portion-subportion Coding

a) (See previous example) Blocks in the same net are coded A1 thru A9, then AA to AZ excluding AI, AO, and AR. If there is another net on the page it will be coded B1 thru B9, then BA to BZ excluding BI, BO, and BR. Other nets will be coded C1, D1, etc. as above. This allows 32 subportions for each portion A, B, C etc.

b) If there are more than 32 blocks on a card, portion A is assumed and subportion numbering goes from 01 to 99. If there is another net on the card it will be numbered B1 thru BZ as in (a) above.

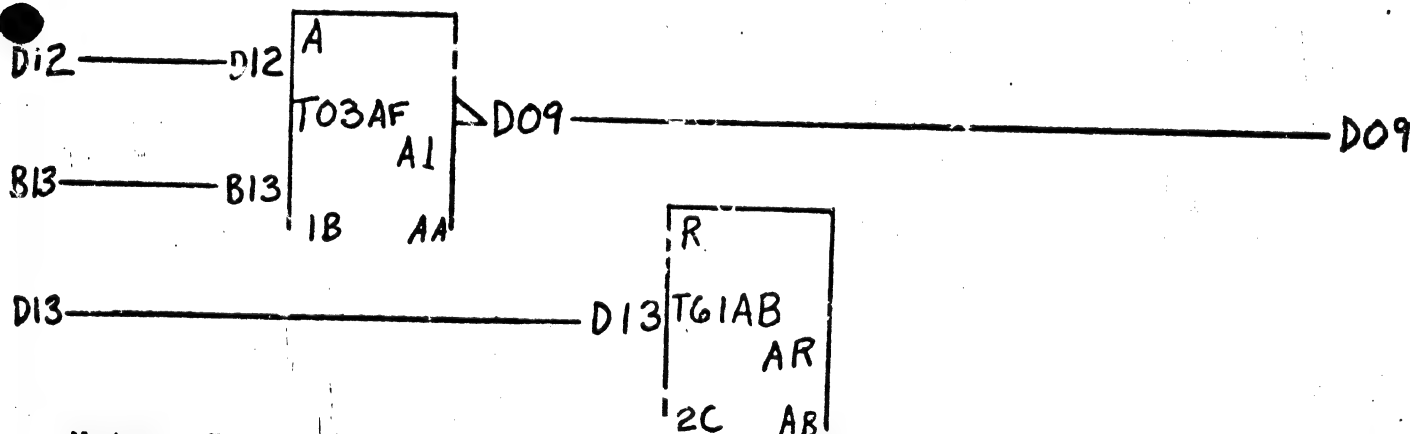
c) Mumzer - The third method of coding is portion Mumzer, where portion A is assumed and only one portion is allowed on this card. Subportion numbering goes from:

00-99
0A-0Z, 1A-1Z.....9A-9Z...........excluding I, O, R
A0-A9, B0-B9.....Z0-Z9...........excluding I, O
AA-AZ, BA-BZ.....~~AZ-AA~~ ZA-ZZ...........excluding I, O and R in the second position.

This routine allows 1122 subportions on a card. Also, there may be 34 card pages numbered 20241, 20242....20249, 20240, 2024A 2024Z excluding 2024I and 2024R. The only limitation to the Mumzer system is that block serial numbering cannot go above KA on any one card page.

Portion-subportion AR, BR, CR, etc.

Portion-subportion AR, BR, CR, etc., may only be used on a "Hybrid Resistor". A "Hybrid Resistor" is a resistor which is tied directly to a card tab and not internally on the card. This allows the designer the option to add a load resistor to the collector portion of the circuit on the systems level.

D12 —— D12 | A | T03AF | A1 | 1B | AA | D09 —— D09
B13 —— B13
D13 —— D13 | R | T61AB | AR | 2C | AB

Note: Both blocks use portion A even though they are not tied together on the card.

Any comments or criticism please call me on extension 4361, Endicott.

H. S. Youse

H. S. Youse
Ground Rule Coordinator
NLT (slow) and Packaging Release Systems Eng.

CC:

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B. Tullis	335	Raleigh
R. Wadsworth	296	Endicott
G. Wilson	C25	Poughkeepsie

HSY:lb

COMMENTS SECTION

This section may contain a maximum of 10 lines with a maximum of 30 characters each.

Line One - contains the card size and card characterization code.

Example:
CARD=SIZE, =2-24=PAC========TØ3

The first 11 characters of the above example are constant on all card logic diagrams.

The equal sign is used to indicate a space.

Characters 12-15 contain the card size. In the example the card size is a 2 socket, 24 SLT module position card. The number in character position 12 indicates the number of socket positions- either: 1 (single socket - 24 card pins) or 2 (2 socket positions- 48 card pins). The number in character positions 14 and 15 indicates the number of standard SLT module positions available on the card - either: Ø6, 12, 24, or 36.

Characters 16-27 in the example are constant on all card logic diagrams.

Characters 28-30 are the card characterization code. This code is in the form ANN (A-Alphabetic; N-Numeric) and is assigned to aid in technically classifying cards. The alphabetic character (family code) is assigned by determining which voltages go to card pins - either: T - +3V, or -3V, or +6V, or any combination thereof.
V - requires only a +12V
U - same as T except that it is specifically associated with the 5 ns family.
S - doesn't fit into any of the other family codes or is a combination of other family codes
O - non-digital type circuitry associated with analog families

The two numeric characters designate the general type of circuitry on the card (see suffix 2, section 25, page 3 for all possible choices)

Line Two - always contains "VOLTAGE=PINS" in the first 12 character positions. The remaining characters are always blank.

Lines Three and Four - contain the voltage pin designations.

Example:
Line 3: +6V,B11,G11=====+3V,DØ3,JØ3
Line 4: -3V,BØ6=====GND,DØ8

COMMENTS SECTION (continued)

The format is to list each voltage followed by the pin designation(s), separated by a comma(s). If a second voltage is listed on the same line it must be separated from the last pin designation of the first voltage by five spaces (=====). See preceding example.

The voltage must be shown by only three characters and may be any of the following forms (N - numeric; S-polarity; V-volts; and M-marginal):

Example:
SNV - -3V
SNN - +12
N.N - 2.4
NNM - 12M
SNM - +6M
GND - GROUND

When more than two lines are required for voltage to pin information, continue on the next line(s).

Only source voltages which are used to function circuitry on the card are to be shown in this section. Voltage created by another card (such as Voltage reference cards) are to be treated as signal lines and are not to be shown in the comments section.

When, due to a marginal voltage, the voltage specified on a circuit flyer doesn't agree with the voltage used on the card, both voltages must be specified. Example: +12,D03=====12M,D03

Line Five - normally contains the Records Classification. If the fifth line is occupied by voltage to pin designations the sixth must contain the Records classification and if the sixth is used for voltage to pin designations the seventh must contain the Records Classification, etc. In any case, the Records Classification must never be in the third or fourth line even if they do not contain voltage to pin designations.

Record Classifications -

Experimental=* This classification is given to cards which are to be produced on a model shop basis for experimental engineering laboratory work. A Card Logic Diagram with this classification must contain an experimental part number ("S" number). See Part Number, page 6).

Developmental=* This classification is given to cards which are to be Development released. Cards at this level have good potential for formal release.

Special Restricted - This is a formal classification applying to those cards which have been technically approved for planned usage in only one product and is restricted due to one or more of the reasons listed in Suffix 2, Section 25, page 1.

COMMENTS SECTION (continued)

Special Active - This formal classification is the same as Special Restricted but is not restricted.

Standard Restricted - This formal classification is the same as Special Restricted except that technical approval has been given for planned usage in more than one product.

Standard Active - This formal classification is the same as Standard Restricted but it is not restricted.

Obsolete - This classification applies to cards which have been found to have no application in present products.

Field Use Only - This classification is used for field replacement only.

Records Classifications are ranked in the following order:

1. Experimental (lowest rank)
2. Developmental
3. Special Restricted
4. Special Active
5. Standard Restricted
6. Standard Active (highest rank)

The card classification may never be higher than that of the lowest ranked circuit flyers used on the card. A card cannot be formally released until all the circuit flyers are, at least, Special Restricted.

Lines Six - Ten - are used for denoting other comments.

Example:

Line 6: *Test=Card=To=Eng=Spec=872491
Line 7: *No=more=than=4=drivers=may
Line 8: *Conduct=at=one=time

Each line of information required to further describe the card (other than card size, card characterization code, voltage information, and records classification) must have an asterisk (*) in its first character position. This additional information may be placed in any line after the records classification, but must never be placed in any line preceding it.

A Card Specifications is required when a card meets one or more of the 3 conditions listed in the suffix 2, section 1, page 1. The Specification number must be inserted in the line immediately following the records classification. The format to follow is shown in the above example.

RECORD CLASSIFICATIONS (continued)

Example of a complete comment section:

```
Line 1    CARD=SIZE,=2-24=PAC========T03
Line 2    VOLTAGE=PINS
Line 3    GND,DØ8=====+12,DØ4
Line 4    +3V,DØ3=====+6V,G11,B11
Line 5    -3V,BØ6,GØ6=====-36,JØ7
Line 6    STANDARD=ACTIVE
Line 7    *TEST=CARD=TO=ENG=SPEC=872491
Line 8    *NO=MORE=THAN=4=DRIVERS=MAY
Line 9    *CONDUCT=AT=ONE=TIME
```

DESIGNER'S NAME

A twelve character field is available in the lower center of the logic sketch sheet for the designer's name. This field must be complete on all Card Logic Diagrams.

The machine printed ALD will contain the designer's name in the title block.

E.C. DATE AND CODE

A maximum of 6 Enginnering change levels are allowed. These change levels must correspond to the change levels listed on the Assembly drawing and must be listed in chronological order.

The E.C. and code field is 8 characters. This field must be complete on all logic sketch sheets.

The date field will be completed by Design Automation. Design Automation will insert the date in which the logic sketch sheet is run. A new date will be inserted each time a re-run is required.

Experimental - cards will contain an E.C. and code in the form SANNN=A (A-Alphabetic, N-Numeric).

The first character (S) is constant.

Character two is the alphabetic area code.

Either:

Boulder	V
Burlington	B
Endicott Circuit Technology	E or T
Endicott Memory	M
Endicott Packaging	Y
Endicott Product Engineering	W
France	F
Germany	G
Holland	L
Kingston	K

E.C. DATE AND CODE (continued)

Lexington	X
Poughkeepsie Circuit Technology	P or H
Poughkeepsie Components Division	C
Poughkeepsie Memory	Q
Raleigh	Z
Rochester	R
San Jose Circuit Technology	J or S
San Jose Memory	A
Sweden	N
United Kingdom	U

Characters 3-5 are sequentially assigned by the controlling group and are the same as the Assembly part number.

Character 6 is blank.

Character 7 is the change code. The initial experimental version will be A and each successive version will be B, C, D, etc.

Example: SE129 = A (Initial version)
SE129 = B (first change)
SE129 = C (second change)

Development - cards will contain an E.C. and code in the form DVNNNN=N (N-Numeric)

The first two characters (DV) are constant.

Characters 3-6 are uniquely assigned to a given Assembly change. Development Engineering Change numbers are obtained from Department 146, Endicott.

Character 7 is always blank (=).

Character 8 is the change code. The inital development release will be 1 and each successive change will be 2, 3, 4, etc.

Example: DV2492 = 1 (Inital release)
DV2768 = 2 (First change)
DV3592 = 3 (Second change)

Formal - cards will contain an E. C. and code in the form NNNNNN=A (A-Alphabetic, N-Numeric).

The first six characters are uniquely assigned to a given Assembly change. Formal Engineering change numbers are obtained from Department 146, Endicott.

Character 7 is always blank (=).

The last character (character 8) is the change code. The initial formal release will be A and each successive change will be B, C, D, etc.

E. C. DATE AND CODE (continued)

Example: 162492 = A (Initial release)
162501 = B (First change)
163219 = C (Second change)

TITLE BOX

Title - The title field is two lines of 30 characters each. Equal signs (=) must be used to indicate spaces.

Example: BIT=TRANSLATORS=AND
COMPLEMENTER

Each title should be a brief informative description of the logic contained on the card. Less meaningfull titles as "Logic Card 1" should not be used.

Machine - this field must always contain the word ASSEMBLY.

Part Number - This field must be complete with either a production or experimental part number. Also see auxiliary title fields, page 7.

Experimental part numbers are in the form S1NNNNN (N-Numeric). The first two characters are constant. Characters 3 and 4 are the numeric position in which the area code is located in the alphabet.

Example: A = Ø1
E = Ø5
P = 16
Z = 26

See pages 4-5 for all possible area codes. Characters 5-7 are sequently assigned by the controlling group. Experimental part number example: S1Ø5392

Production part numbers are in the form 58ØNNNN (N-Numeric).

Production part numbers are obtained from Department 146, Endicott.

Version - This field is always blank (does not apply to card logic diagrams).

Division - This field must contain the two character alphabetic code of the group and/or location technically controlling the card. See Suffix 2, Section 25, Page 2 for all possible control codes.

Frame - This field is always blank (does not apply to card logic diagrams).

PAGE NUMBER

The page number is used to identify the sheet number of card logic diagrams. The page number is also used as part of the information in the Line Information fields to indicate cross-referencing between pages (see Section 4, page 3).

The page number must be inserted in the indicated spaces at both the upper and lower right-hand corners of the logic sketch sheet.

It consists of the characters 2-5 of the current E.C. when the card is Experimental and the last four characters of the part number when the card is Development or Formal.

In each case, the first 4 characters are followed by a numeric character indicating the page sequence.

Example:

An experimental card S1Ø5396 at E.C. level SE396=B has three ALD pages. The pages are numbered E3961, E3962, and E3963.

A development card 58Ø4521 at E.C. level DV2481=3 has three ALD pages. The pages are numbered 45211, 45212, and 45213.

A formal card 58Ø1632 at E.C. level 162491=A has three ALD pages. The pages are numbered 16321, 16322, and 16323.

AUXILIARY TITLE FIELDS

These are 14 character fields, two lines above the logic block positions in row A (top row) of the logic sketch sheet. These character fields, except the fields above block drawing positions A6 and A7, may be used for block column titles.

For record and control purposes, it is necessary that the sheet and part number be called out in the upper right of the ALD. To satisfy the need, the Auxiliary title fields above block drawing positions A6 and A7 are used.

The auxiliary title field above block drawing position A6 will contain the sheet number and reference to the total number of Assembly sheets. The total number of Assembly sheets include the ALD, Schematic, and Assembly Drawing, in that order.

Example:

The Assembly Package contains: 2 ALD sheets, 3 schematic sheets, and 1 Assembly drawing sheet. Insert above block drawing position, in the auxiliary title field, A6:

First ALD Page Sheet=1=of=6
Second ALD Page Sheet=2=of=6

AUXILIARY TITLE FIELDS (continued)

When the ALD is being run by Design Automation, previous to knowledge of the total number of pages the Assembly package will contain, the total number of pages figure may be blank. In this case, Release Packaging Engineering, Department 146, Endicott will insert the total number of pages figure by hand, on the machine printed ALD.

Example: Sheet 1 of 3

The auxiliary title field above block drawing position A7 must contain the Assembly part number (see page 6).

DECOUPLING CAPACITORS

Standard decoupling capacitors used to decouple standard voltages must not be shown on the ALD. When either a different decoupler than .68 uf. is used or a voltage other than +3, -3, +6, +12, or -12 is decoupled, the capacitor block must be added to the ALD.

For the case where standard voltages are decoupled with other than a .68 uf. capacitor, the following circuit flyers must be used on the ALD showing connection to the appropriate card pin:

S61DE - Uses 10 uf. capacitor, has input and output on logic block.

S61TB - Uses 6.8 uf. capacitor, has input and output on logic block.

ST. R. S61DW - Uses 6.8 uf. capacitor, positive terminal to input of logic block, negative terminal grounded on flyer.

S61UO - Uses 6.8 uf. capacitor, positive terminal grounded, negative terminal to logic block input. $

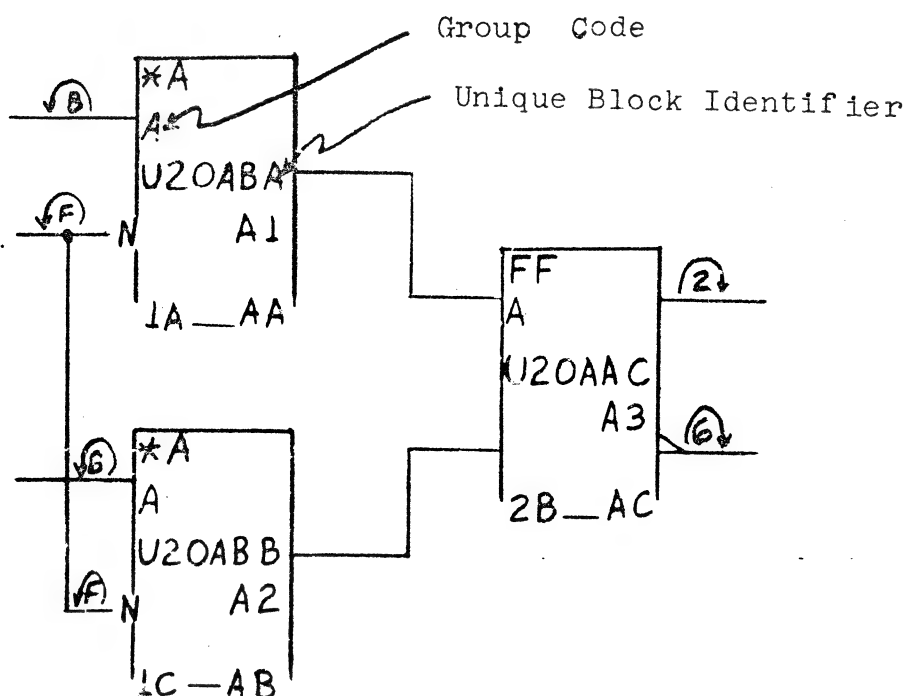
S61UT - Uses 6.8 uf. capacitor, negative terminal to logic block input, positive terminal shown to +6 volts on the Circuit flyer. $

For the case where the standard decoupler, .68 uf. capacitor, is used with non-standard voltages:

S61DG - Uses .68 uf. capacitor, negative terminal grounded on flyer, positive terminal to logic block input.

ST. R. S61TW - Uses .68 uf. capacitor, has input and output on the logic block.

INTEGRATED CIRCUITS

The following is an example of the way an integrated circuit must be coded on an ALD so that the PUNSC Program can handle it automatically.

EXAMPLE:

Group Code
Unique Block Identifier

*A
A
U2OABA
A1
1A—AA

*A
A
U2OABB
A2
1C—AB

FF
A
U2OAAC
A3
2B—AC

GROUP CODE

The Group Code is an alpha character associated with one integrated circuit that is posted in the first position of line two of all the related blocks. The Group Code will be different for every integrated circuit used on any one card ALD.

Unique Block Identifier

Each block in an integrated circuit is uniquely identified by an alpha character posted in the sixth position of line three. The unique block identifier is obtained from the design automation block representation portion of the circuit flyer. The blocks are identified alphabetically with the left-most, upper-most block being identified as "A" and proceeding top to bottom, left to right.

COMBINED FLYERS

Combined Flyers as defined in Section 23 of Suffix 2 are to be coded as follows:

Place an asterisk in line 3, position 6.

EXAMPLE:

A
VO3AK*
A1
1A — AA
E
(4)
(7)

SCOPE

This suffix covers the design requirements for the card wiring, component placement and other design considerations required for SLT card layout.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

This section will include Information, Requirements, Planning, Note Codes, Justification and Terms that are general and specific to all SLT cards and/or components.

REQUIREMENTS

Justification Procedure -

All standard SLT Card assemblies not including specials (Suffix 7) that require justification as described under (A&B) must have prior approval from Department 146, Endicott before the card will be processed for release.

Procedure For "On Location" Manufacturing Pre-Analysis

The "On Location" Manufacturing Pre-Analysis Representative is not responsible for giving manufacturing approval to card justifications. However, he is responsible for detaining any card which requires justification but for which justification approval has not been obtained. These cards will be detained until approval is received as outlined under REQUIREMENTS. When approval is obtained and no other problems exist on the card, the card will be passed by the Pre-Analysis Representative. Endicott Manufacturing Pre-Analysis will inform the Pre-Analysis Representatives when a decision by Endicott Manufacturing has been made on the card. The above is for cards being processed for initial release.

Cards being processed on "EC" change which have previously been justified are handled differently than cards being released which require initial justification. If the "On Location" Manufacturing Pre-Analysis Representative has not been notified by Endicott Manufacturing Pre-Analysis to pass the card on to ask for rejustification, then he must notify Endicott Manufacturing Pre-Analysis of his receipt of the card. The Pre-Analysis Representative must at the same time inform Endicott Pre-Analysis of any forecast changes or any change in the number of conditions that were previously justified. In turn, Endicott Manufacturing Pre-Analysis will inform him as to the action to be taken on the card. If a card requires re-justification, the procedure for the "On Location" Manufacturing Pre-Analysis Representative will be the same as for a card being released for the first time that requires justification.

REQUIREMENTS (CONTINUED)

Pre-Pre-Analysis -

Advance review of cards by Department 146 that have problems or may need justification will be answered by letter indicating the following:

Approval, rejection and or action that must be taken that would make the card acceptable. The above is not a requirement for card release.

Normal Pre-Analysis -

Once approval has been given, it will have automatic approval on subsequent changes only if the following items are met.

1. Any card previously justified will include a copy of the previous letter for the new EC on that card.

2. An updated 5 year usage forecast by year is required. It may be hand written on the previous letter and is required to be signed and dated. It is up to the discretion of the Endicott Manufacturing Pre-Analysis as to whether or not the increase is sufficient to warrant justification.

3. The cards must be rejustified if the number of conditions that were previously justified have increased and or any new conditions have been added as described under (B).

   Rejustification means a new letter.

4. The requirements for requesting approval by a letter of justification or re-justification are to include the following data and it is to be submitted to Messrs R. E. Canfield, and L. R. Nemeth, Department 146, Endicott.

   4.1 A reproducible copy of the proposed rough assembly layout.
   4.2 A 5 year forecast of card quantity by year.
   4.3 Signatures of Machine Project Manager and a responsible Engineer.
   4.4 A description of machine requirements justifying the conditions created on the card. All justification is the responsibility of the affected machine group.

   Items 4.1-4.4 will be submitted to the designated manufacturing representative located in Department 146 Endicott. If any complications arise out of the review or when approval is given, the controlling card packaging group will be notified by letter as stated in Pre-Pre-Analysis.

REQUIREMENTS (CONTINUED)

Reasons for Justification -

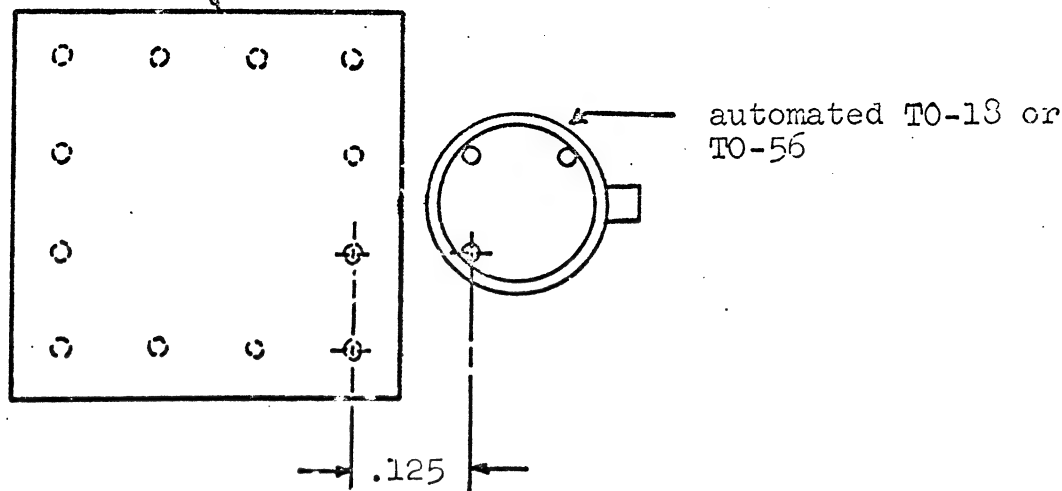
Justification is required for automated components which will be hand assembled as well as those that are considered as being automated by the high speed equipment and are not defined as ground rule violations. For these components, the specific violations of automation rules which must have a letter of justification are as follows.

SLT Circuit Modules Packaged in Physical Outline Codes - 7M906C-7M906H - 7M906B - Other module physical outlines exist which, at this time, cannot be automated. Consideration of these outlines must be given with respect to the physical outlines and/or size of the adjacent components and with respect to the card layout as to whether a problem exists. Also, the automatability of the adjacent component by itself, must be examined. If a problem exists and the adjacent component is normally automatable, a letter of justification is required.

Example:

Non-automated or automated module with an un-insulated or electrically floating case.

automated TO-18 or TO-56

.125

This condition requires a letter of justification because an insulating spacer must be used which makes the automatable transistor Hand assembled. If a Hand assembled module has an insulated can, then the spacer would not be needed and a letter of justification is not required.

R/C Modules Packaged in Physical Outline Codes
2A801G4-A4-C4-E4
4A803D-A-B-C
6A805A-B-C-D

REQUIREMENTS (CONTINUED)

Although the ground rules defined eight of these outline codes as being non-automatable, this is true only at this point in time. An extensive effort is being made to obtain all of these components in the four automatable outlines. Hence, card layout must reflect this. Two or more R/Cs with any of the preceding outlines which are "brickwalled" as defined in the section on R/C modules must be justified.

Transistors Packaged in Physical Outline Codes -

16T56A-B-C
1T18A-A1-B-C

Although only physical outline codes 16T56A-B-C are defined as presently being automatable, Engineering Change Requests have been issued on the 1T18A-A1-B-C outlines to change them to a TO-56 outline. In lieu of the processing of these Engineering Change Requests, all seven of these packages must be laid out for automation. Any package with one of the above outlines which is not automatable due to physical placement or due to an artwork violation, must be justified. In addition, when any of these seven packages or 1T-18P and 20T72B are mounted in .250 inch centers, additional manual assembly cost is incurred. Packages mounted in this manner must be justified.

Tubular Axial Leaded Components

Automation of these components is a must and any component meeting the requirements but is on the card so that it has to be hand assembled will require justification.

The following Diode physical outline codes must be considered as being automated on .500 or .625 mounting centers.

1D07-C-C2-D
2D500A-B-C-D
2D500A1-A2-B1-B2-B7
6D514A1
42D540A
45D29A
46D542A

The component part drawings using the above outlines do not have minimum dimensions on them but Engineering Change Requests are being processed to update the part drawings.

Any card using any of the above physical outline codes which are not automatable due to physical placement must be justified.

Any automatable component which meets the Automation Insertion Chart, except for the hole size and/or the mounting centers, must be justified.

REQUIREMENTS (CONTINUED)

Snuggling of two or more automated components or one automated component that has to be hand assembled must be justified.

Upper Third of 3-Hi 12 Cards -

Present high speed automatic equipment can insert components on a .025" increments on the 5 standard SLT card sizes up to and including Y grid 123. An effort is being made to extend the range of the automation equipment up to and including Y grid 183. Card layout above Y grid 123 must reflect the component ground rules for automatic assembly. The deviations requiring justification are as defined under item B and apply to the upper third of 3-Hi 12 cards.

This write-up describes (all B items) the conditions which require justification at this time. Certainly, other situations will come to the light in the future that will also require justification. These conditions must be handled as they arise, and this write-up will be modified to reflect them. When in doubt as to whether a card requires justification or not, contact Messrs. R. E. Canfield or L. R. Nemeth, Dept. 146, Endicott.

INFORMATION

The following components are controlled by Dept. 287, Poughkeepsie, Plant 16. Engineering Change Requests should be submitted to the Department manager who will in turn log them in and route them to the responsible Applications Engineer for action.

SLT Modules
Pulse Transformers
Tantalum Capacitors
R/C Modules
Transistors
Delay Lines
IC Modules
Crystals
Diodes

The majority of all other electrical components are controlled by Dept. 382, Endicott.

Inductors
Capacitors
Resistors
Potentiometers
Fuses

Dept. 561, Burlington controls reed relay assemblies.

Dept. 146, Endicott, generally controls SLT mechanical and hardware items on cards.

PLANNING

Those components that are in the present SLT Card Bulletin Ground Rules through B23 are still in effect unless superceded by this Engineering Practice update. Those items that are not in this update will be published as soon as they are written.

Card layout and manufacturing trade-off data will become available soon and will be in this section. This data will

PLANNING (CONTINUED)

aid the machine and layout people in deciding whether components will be hand assembled or go to a random hole pattern, etc.

TERMS

FLAG - Component lead that is bent 30° - 45° on the solder side of the card.

CLINCH - Component lead that is bent 90° on the solder side of the card and flat to a large land.

PINCHED - Component lead that has been deformed to form a projection larger than the lead diameter.

PREPPING - Component leads that are cut, formed and made ready for insertion on the card assembly.

LEAD CIRCLE - Component leads that have the relationship of being on the same diameter circle or radius.

MOLDED - Components that are processed to a finished part by transfer and/or injection molding.

SHELL MOLDED - Components that are assembled in a case that has been previously molded.

CAST OR POTTED - The filling of an assembled shell-molded component.

ELECTRICALLY FLOATING - A metal can or case that is not insulated and not connected to the device it covers.

STANDOFF - A projection on the component body or lead that may or may not be insulated and elevates the component from the card surface in order to cool the component, clean flux from the card and to allow soldering of the component leads.

SEATING PLANE - Is that area where component standoffs are in contact with the card surface.

AUTOMATIC - SLT high speed component insertion equipment that is capable of insertion on a .025 grid increment and is computer controlled.

SEMI-AUTOMATIC - Equipment that is manually positioned and cycled which can only insert components on X-Y grids ending in 3 and 8.

TRADE OFFS - Those decisions made from known data that influence card layout and card cost.

BRICKWALLED - Two or more R/C modules packages that have any part of their lengths side by side and have their centers less than .200".

TERMS (CONTINUED)

WET PROCESS - Initial part of raw card manufacturing process which includes the use of many chemicals, plating and cleaning solutions.

NON-WETTABLE - (Do not subject to liquids) - Components which by themselves or due to the method of assembly cannot be processed in the Automatic Solder and Cleaning Machine. Within this machine components would be subjected to FLUX, HEAT, SOLDER, CLEANING SOLUTION AND ULTRA-SONIC VIBRATION. Component configuration and mounting must allow complete flux removal. Also components must not exceed .460 in height or diameter.

WETTABLE - Components which by themselves and due to the method of assembly can be processed in the Automatic Solder and Cleaning Machine.

OBSOLESCENT - This applies to note codes that cannot be used on any new card releases. Any presently released card using these notes must be update when processed on change.

CARD GUIDES - An insulated mechanical part that is retained to the card assembly which will stiffen the card, guide the card for seating, and retain the card assembly during vibration.

GUIDE POST - A flat metal post that is mounted on the plastic board stiffner on which the card guides are inserted.

NOTE CODES

The note code structure is being closely examined to:

a. Elimination of manufacturing process information which can vary and makes the presently release cards wrong.
b. Elimination of many combinational note codes.
c. Elimination of the use of variable field note codes.
d. More definition on the application and meaning of note codes.

Most of the changes planned for note codes cannot be used until CCDA and manufacturing program changes have been made. Component Library will also be affected.

When no note code exists for a non automatable component on a card assembly on the assembly drawing in the note code field, or in the component library, the component will be mounted on the card during the Manual Insertion Operation before Flow Solder and Clean. Also, the component will be mounted without spacers or any other hardware in the manner in which the assemblers interprets the assembly drawing using as a guide his assembly experience and all applicable Manufacturing Process Standards. Any note code for a component on a card assembly that exists only in the component library is readily accessible only to the computer which must reflect this note code on the Manufacturing Positioning for that card assembly. The need and or the note code is determined by Department 146, Endicott.

HD - "Hand Assemble Before Liquid Process"-

This note code is OBSOLESCENT. (This note code is not to be used on any component. Any card which uses HD note codes being processed on an Engineering Change must have all HD note codes removed. Cards with HD on the assembly drawing are acceptable until changed.)

HR - "Component Incompatible with Manufacturing Process"-

(This is a new note code. It is used to specify a normally automated component which must be hand assembled for a reason which cannot be detected by the manufacturing computer programs. At this time this note code must be placed on any automated tubular axial leaded component which meets the automated insertion chart (Section 9) except for Hole size.)

NB - "Assemble with P/N 476744 Spacer. Do not subject to any Liquid".)

(Required for non-wettable round potentiometers packaged with TO-5 Lead configuration. Example - Potentiometer 483114.

NOTE CODES (CONTINUED)

This note has not changed and will appear on the component and note field on the Assembly Drawing.)

FH - "Due to Component Height of .370 to .460, This card must be removed prior to removal of card adjacent to component side."-

(Required when any component height is between .370 and .460. This note has not changed but will appear only in the note code field on the assembly drawing. New card releases and changes will not reflect the note code on the component view. As a result of this note a .250 black mark is put on the left card edge to identify the card to the machine group and the customer engineer.)

FR - "Due to Component Height of .370 to .460 this card must be removed prior to removal of card adjacent to component size. Tech lab evaluation incomplete. Part subject to withdrawal. Additional usage to be avoided."

This note is obsolescent and replaced by FH and FA. (New releases and changes will not reflect this note on the assembly drawing. Those present assembly drawings with this note are still valid. A black mark on the left card edge is still required when it is used.)

FV - "Assemble with P/N 811399 (TO-5) spacer. Due to Component Height of .370 to .460, this card must be removed prior to removal of card adjacent to component side."

(Required when using transistor type 028 or physical outline 6T11A for example. This note code will appear on the component and in the note field on the card assembly drawing. A black mark on the left card edge is still required.)

FB - "Card requires 1.250 spacing on front side."

(This note code is required when any component height is over .460". This note code has not changed but it will appear only in the note code field on the assembly drawing and not on any specific component. New releases and changes will not reflect the note code on the component view. When the FB note code is applied to a card, the component (s) which is over .460" in height must have an NA (or other non-wettable note code) assigned to it in the component library or must have an NA (or other non-wettable note code) applied to it on the assembly drawing and note code field. In addition, Card Clearance Section 7 must be met.)

NA - "Part must not be subjected to any liquid"

(This note code is OBSOLESCENT for most card assemblies and is usually only for component library use. With one exception, this note code will not appear on the component on the assembly drawing nor its note code field. However, the NA note code, with the present CCDA programs, will automatically print out on the assembly drawing when the note code exists on the component library. Until CCDA program changes are made and implemented to suppress printing on the assembly drawing, cards

NOTE CODES (CONTINUED)

will be accepted for release and change processing which contain NA printed out on the assembly drawing.

The one exception to the above rule is the case where a component for which no NA note code exists on the component library is mounted such that is extends more than .460" above the card surface. This component must have an NA note code on it on the assembly drawing and in the note code field. Also, an FB note code must be put in the note code field on this assembly drawing. For further classification of non-wettable components, contact Dept. 146, Endicott.)

NC - "Part must not be subjected to ultrasonic frequency of 35-45KC."

(This note code is OBSOLESCENT for card assemblies and is for component library use only. This note code will not appear on the component on the assembly drawing nor its note code field. However, the NC note code, with the present CCDA programs, will automatically print out on the assembly drawing when the note code exists on the component library. Until CCDA program changes are made and implemented to suppress printing on the assembly drawing, cards will be accepted for release and change processing which contain NC printed out on the assembly drawing.)

HA - "Assemble with P/N 811157 (TO-18) Spacer."

This note code, with one exception, is required on all TO-18's and TO-56's packages on the assembly drawing and in the note code field. Only those TO-18's and TO-56's which must carry an HS note code are exempt from this rule.)

HS - "Assemble with P/N 815192 (TO-18) insulating spacer."

(This note code is required on all TO-18's and TO-56's which are mounted .125" adjacent lead to an SLT Circuit Module. This note code for these transistors must appear on the component on the assembly drawing and in the note code field. The P/N 815192 (TO-18) spacer is a newly released spacer that will ensure that the transistor and SLT Module involved will be mounted with a minimum of .008" clearance. The use of this spacer in this situation is an engineering requirement. All presently released card assemblies using an AZ note code on these transistors must have the AZ replaced by the HS when the cards are processed on a change.)

FK - "Mount heat sink using SI grease (P/N 483151) on the transistor can. SI grease must be applied after liquid process."

This note code is required on press-fit heat sinks mounted with silicon grease during the manual assembly of non-wettables Operation. The note code must be on the heat sinks on the assembly drawing

NOTE CODES (CONTINUED)

and in the note code field. This note code must not be applied to gear type heat sinks (P/N 492434 or P/N 492435) mounted on TO-5 transistor. Particular applications of this note code are given in the sections containing specific information on the various packages and heat sinks.)

FJ - "Mount heat sink with flared fins up and flush with top of transistor can." This is not OBSOLESCENT.

(The use of this note code is no longer required. All presently released card assemblies using an FG note code must have the FJ note code removed when the cards are processed on a change. This will be taken care of in the Manufacturing Process Standards.)

CARD SIZE

Two methods of describing card size will be shown. Both systems are derived from multiples of the basic or smallest SLT standard card configuration. The method on the left is the preferred method and will replace the old method equivalent on the right.

Method #1 Preferred	Method #2 Old	
1-6	1-HI 6	
2-12	1-HI 12	
1-12	2-HI 6	
2-24	2-HI 12	
2-36	3-HI 12	
3-36	2-HI 18	INFORMATION ONLY
4-48	2-HI 24	

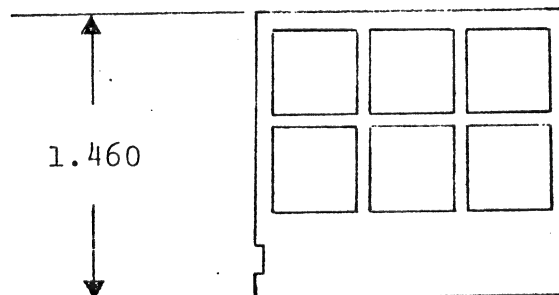
The preferred Method #1 is translated by the following:

The first numeric indicates the number of socket positions. The numerics following the hyphen indicate the total number of SLT modules that can be used on cards with a standard internal plane.

The old Method #2 is translated by the following:

The card height (HI) is indicated by the first numeric. The total number of SLT modules that can be used on cards with a standard internal plane can be derived by multiplying the first numeric by the numeric following the height (HI).

Basic SLT Card Size
1-6

1.460

CARD STATISTICS

The illustrations entitled "Card Dimensions" show the following information for card sizes. 1-6, 2-12, 1-12, 2-24, 2-36. The module placements on the following views are for standard placement using a standard internal plane.

1. Dimensions - See Engineering Specification 890911.
2. Grid Numbering System
3. Orientation of Sides
4. Standard Hole Pattern Position
5. Preferred Module Positions

MODULE (FRONT) SIDE

2-12

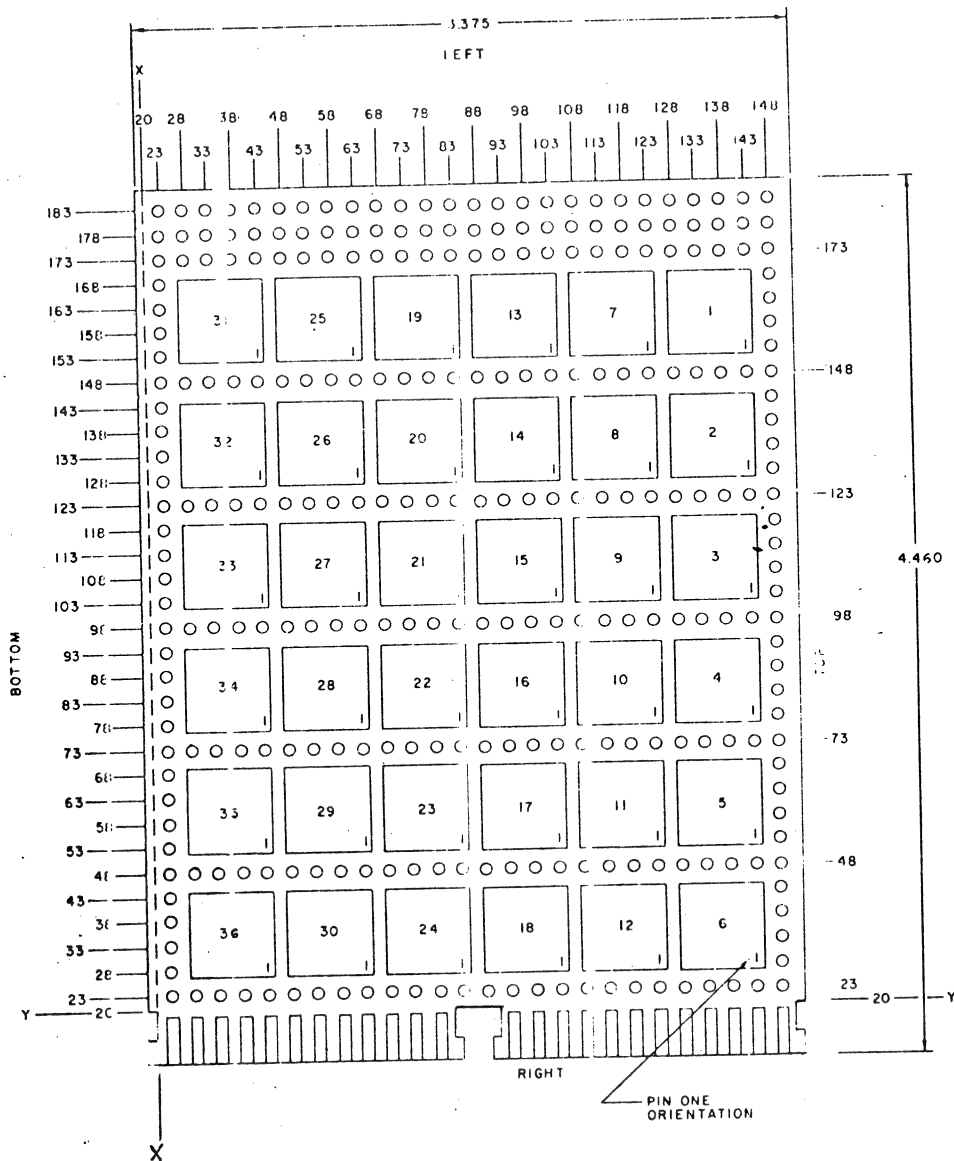
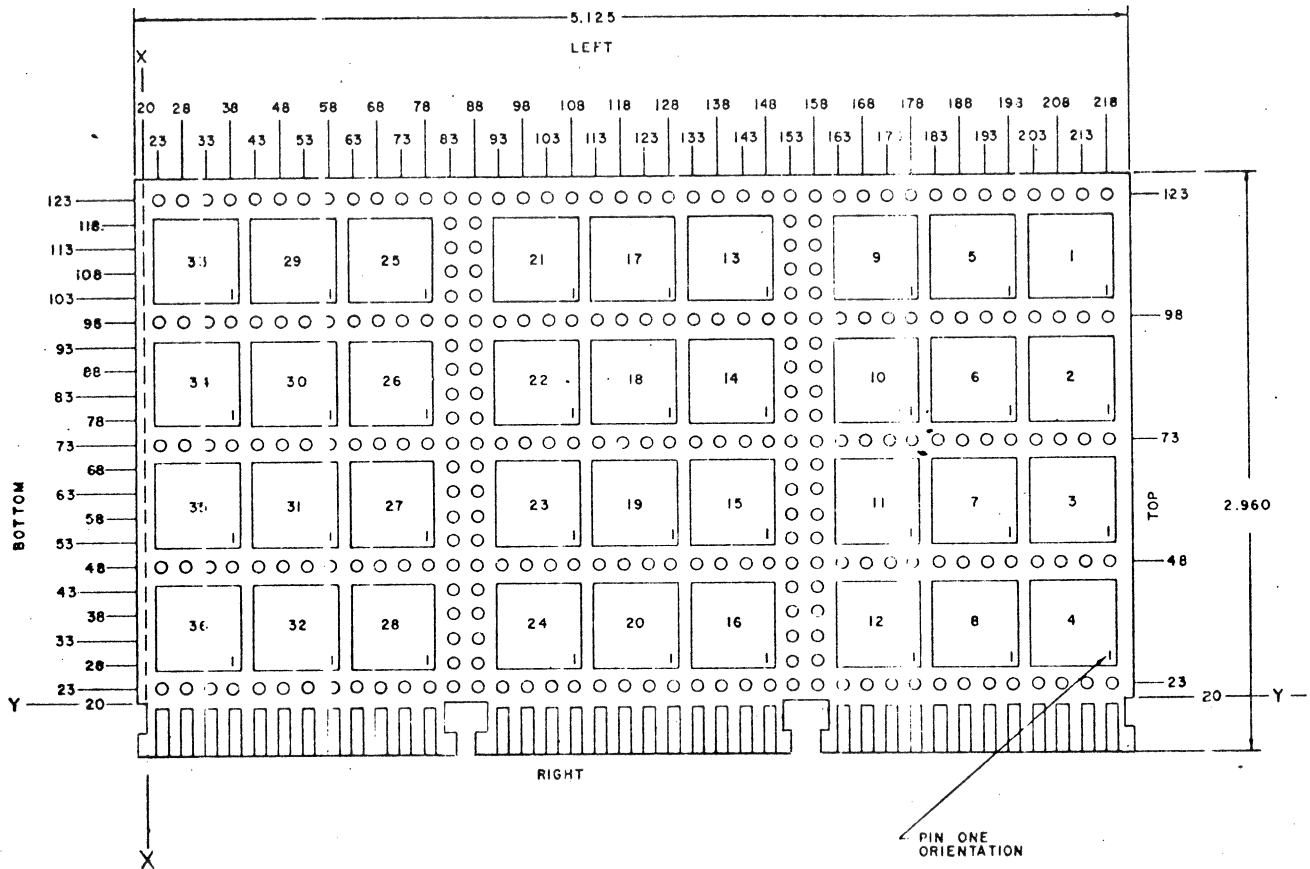
MODULE (FRONT) SIDE

1-6

MODULE (FRONT) SIDE
1-12

MODULE (FRONT) SIDE
2-24

MODULE (FRONT) SIDE

2-36

MODULE (FRONT) SIDE

3-36

Note: 3-36 shown for reference only.

MODULE (FRONT) SIDE

4-48

TOP

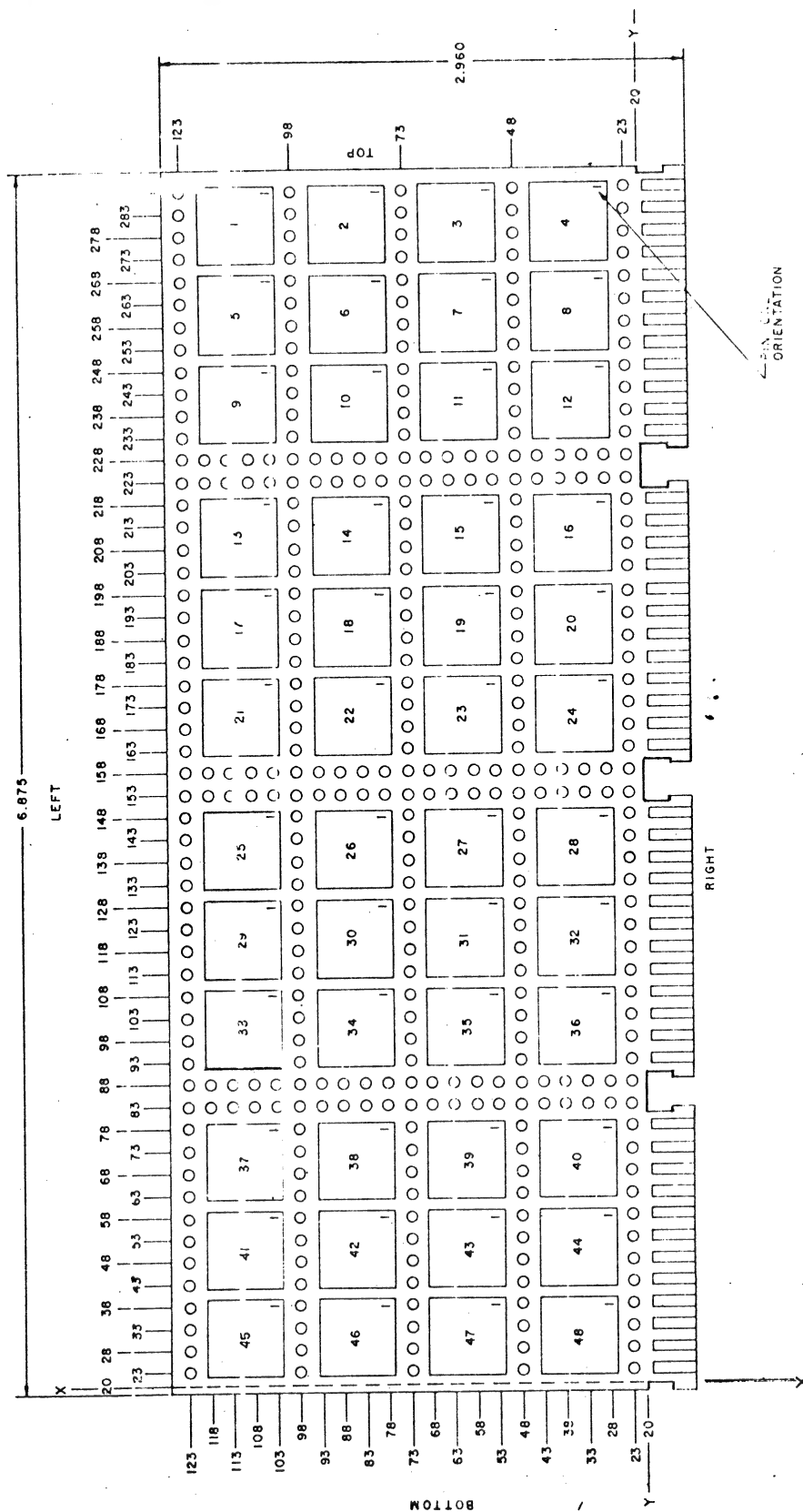
BOTTOM

LEFT

RIGHT

6.875

2.960

ORIENTATION

NOTE: 4 - 48 shown for reference only.

STANDARD CARD AVAILABILITY

The cards listed on a preceding page (under CARD SIZE) are the only ones available as standard cards in the program. Any other cards sizes must be considered as "special" (See Suffix 7 "Special Cards"). The 3-36 and 4-48 cards are shown for information only. These latter 2 sizes are not available from computer generation.

MODEL CARD AVAILABILITY

Ordering -

Raw card material for engineering model cards is available by ordering part numbers shown in the model cards availability table. Additional operations to be performed in the local model shop for the completion of raw cards are described below.

Card Panel With An Internal Plane and No Holes -

The internal plane without holes has a laminated internal plane copper clad on both sides. Operations required for completion of raw cards would be drill, plate (for via holes), resist, etch, mill into cards, contacts, housing, and protective coat if required.

Card Panel Without Holes or Internal Plane -

An epoxy panel copper clad on both sides without internal plane is available as P/N 9799250. This panel requires the same operations as described above for completion of raw cards.

Internal Plane Card Panel With Holes -

This panel with standard holes has a laminated internal plane with "J" holes drilled at all X and Y grids ending in 3 or 8 with holes plated through. Operations required for completion of these raw cards would be resist, etch, mill into cards, contacts, housing, and protective coat if required.

Wire-It-Yourself Cards -

Wire-it-yourself cards have "J" holes with lands at all standard grids. Cards are etched with contacts and housing assembled. Printed lines are run from each tab to a land on Y23 or Y28. To complete the card discrete wires are connected between lands by lap soldering to the land. Refer to Engineering Specification 890926 for discrete wire connections.

Etch-It-Yourself Cards -

Etch-it-yourself cards are in card form both with and without internal plane. They are supplied with standard holes drilled and plated through and tin-lead plating on holes, lands, and ALPHA 38 flux already on tabs. Operations required for completion of these raw cards would be resist to wiring only, etch, contacts, housing, and protective coat if required.

NOTE: Laminate Without Holes - This is ordered in panel form under the part number appearing in this column (this is not the panel part number but the laminate part number).

MODEL CARD AVAILABILITY

CARD SIZE	BASIC CARD MATERIAL (PANEL) Laminate without holes	Laminate with Standard Hole Pattern		ETCH-IT-YOURSELF		WIRE-IT-YOURSELF
ALL SIZES	No plane	9799250 no holes				
1-6	No plane	811661		5812127	14 LEAD FLAT PAC 5832541	5800033 5800882 Note 3
2-12	No plane	811663		5812130		5800034 Note 3
	V-Ground Plane	815929 Note 1		5833130 Note 2		
1-12	No plane	811665		5813630		5805918
	V-Ground Plane 811071	811666		5813501		5805920
	Ground Plane 811813			5813799		5805919
2-24	No plane	811667		5813632	14 LEAD FLAT PAC 5832543	5805921
	V-Ground Plane 811072	811668	14 LEAD FLAT PAC 813627	5813504	14 LEAD FLAT PAC 5832542	5805923
	Ground Plane 811814	815131		5815525		5805922
	V-Ground Plane	*815928		5833131 Note 2		
2-36	No plane	811670		5819007		5805924
	V-Ground Plane 811725	811729				5805926
	Ground Plane 811231	811671		5814995 B		5805925
	Ground Planes 811230 811811 811697	811672 811812 811698		5813645 A		

NOTES:
1. Laminate available, but not drilled.
2. SLD 100 & 700 NS Cards.
3. No Contacts And Housing.

Part Numbering Requirements for SLT CARD DOCUMENTS:

Document numbering requirements are dependent on the type of card being released. Refer to the following chart.

SLT STANDARD VARIATION AND PART NUMBERS REQUIRED

DOCUMENT	Card With Electrical Components, Contacts And Housing		Card With Contacts And Housing No Electrical Components		Cards With No Electrical Components, Contacts or Housing	
	Manual	Automated	Manual	Automated	Manual	Automated
Card Automated Logic Diagram	580XXXX	580XXXX				
Assembly Drawing	580XXXX	580XXXX				
Electrical Schematic	580XXXX	580XXXX				
Raw Card Drawing	581XXXX OR 583XXXX	581XXXX OR 583XXXX	580XXXX	580XXXX	581XXXX OR 583XXXX	581XXXX OR 583XXXX
Artwork Front	581XXXX Cronaflex	Shown on Raw Card Drawing	580XXXX Cronaflex	Shown on Raw Card Drawing	581XXXX Cronaflex 583XXXX	Shown on Raw Card Drawing
Artwork Back	581XXXX Cronaflex 583XXXX	Shown on Raw Card Drawing	580XXXX Cronaflex	Shown on Raw Card Drawing	581XXXX Cronaflex 583XXXX	Shown on Raw Card Drawing
Hole Pattern	81XXXX	Shown on Raw Card Drawing	81XXXX	Shown on Raw Card Drawing	81XXXX	Shown on Raw Card Drawing

- The front and back artwork will always carry the same document part number.
- If the raw card number and hole pattern part numbers are in the same series, all documents in the major raw card drawing group will carry the same number.

HOLE PATTERNS

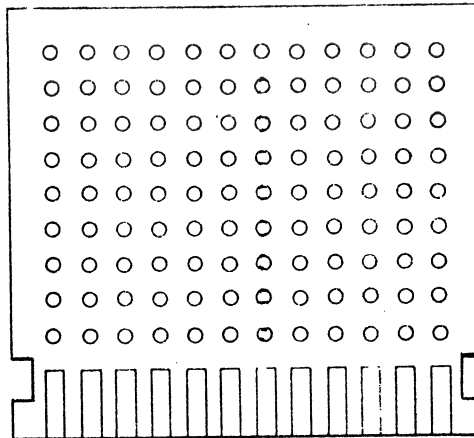
Hole Patterns are classified into one of three categories. These categories are random-standard, random, and standard. The definition and example for each of these categories is as follows:

Standard Hole Pattern

A standard hole pattern consists of only "J" holes located on all X and Y grids ending in the digits 3 or 8.

The definition above means that the "J" holes must be drilled in all of the standard locations. If one hole is omitted, this hole pattern will become random-standard.

Available standard hole patterns are as follows:

CARD SIZE		HOLE PATTERN
1-6	-	811192
2-12	-	811193
1-12	-	811370
2-24	-	811371
2-36	-	811229

EXAMPLE: All Holes Are Drilled On Grids Ending In The Digits 3 or 8.

Random-Standard

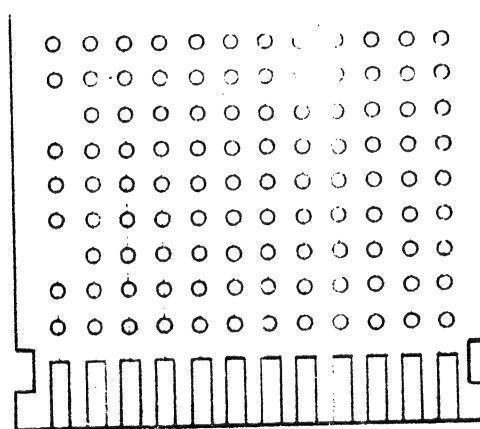
A random-standard hole pattern which has drilled holes on X and Y grids ending in 3 or 8, but not all hole locations on X and Y grids ending in 3 or 8 are drilled.

On the standard hole patterns, lines running through any Grid location where both X and Y grids end in either 3 or 8 (Standard hole position), a hole and land must be provided and is considered a functional hole.

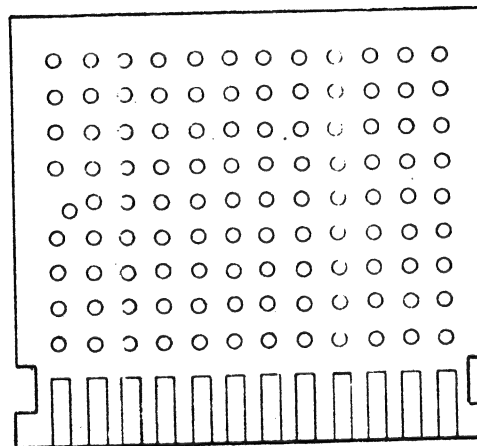
All holes related to land-pads used for flat pac mounting are to be considered functional whether or not they are required for electrical completion of the circuit.

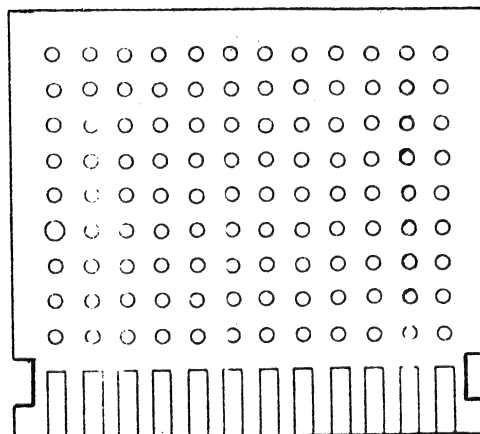
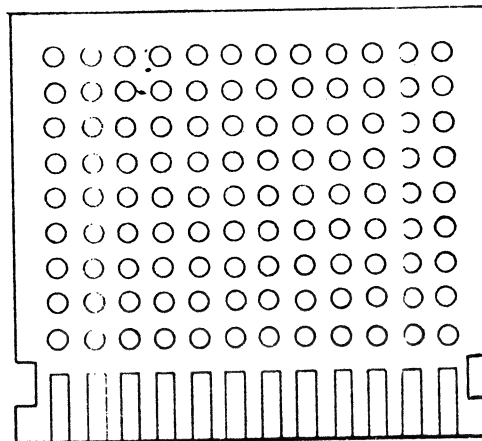
Cards should use the standard .125 hole position whenever possible. However, due to the component lead mounting or some other design consideration, a random hole pattern may be used.

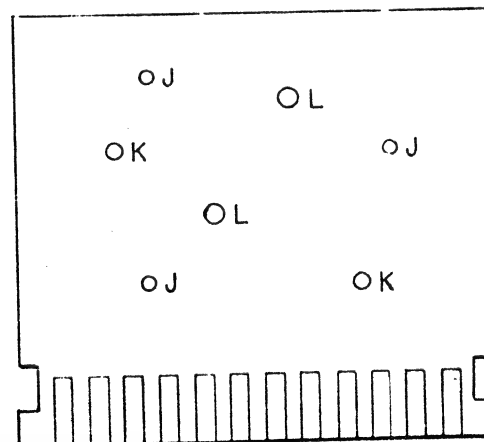
Random - Standard (cont'd)

Example: All holes shown are on grids ending in the digit 3 or 8 but some holes are not drilled.

Random Hole Pattern

A random hole pattern consisting of not all "J" size function holes and/or holes not all located on X and Y grids ending in 3 or 8. All holes must be centered on the basic SLT grid pattern of .025 inches. The outer hole limits of the random hole pattern are shown in the illustration entitled "Card Restricted Areas" and the following illustration.

Example: Hole location grids ending in the digit 3 or 8.

Random Hole Pattern (continued)

Example: All holes are "J" and on grids ending in the digit 3 or 8, except for at least one hole which is not a "J" hole.

Example: All holes are on grids ending in the digit 3 or 8 but all of the holes are of a size larger or smaller than a "J" hole.

Example: All holes shown are of various sizes and may or may not be on grids ending in the digit 3 or 8.

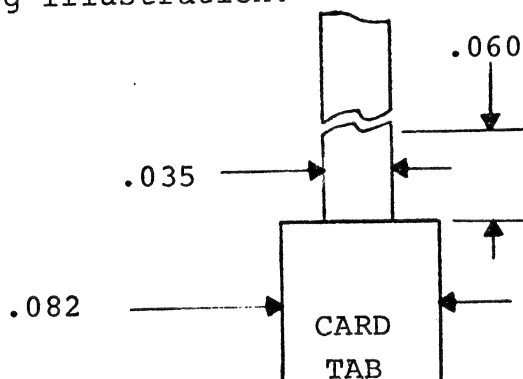
J L K J L J K

PRINTED CIRCUIT WIRING LINES:

Available line widths-

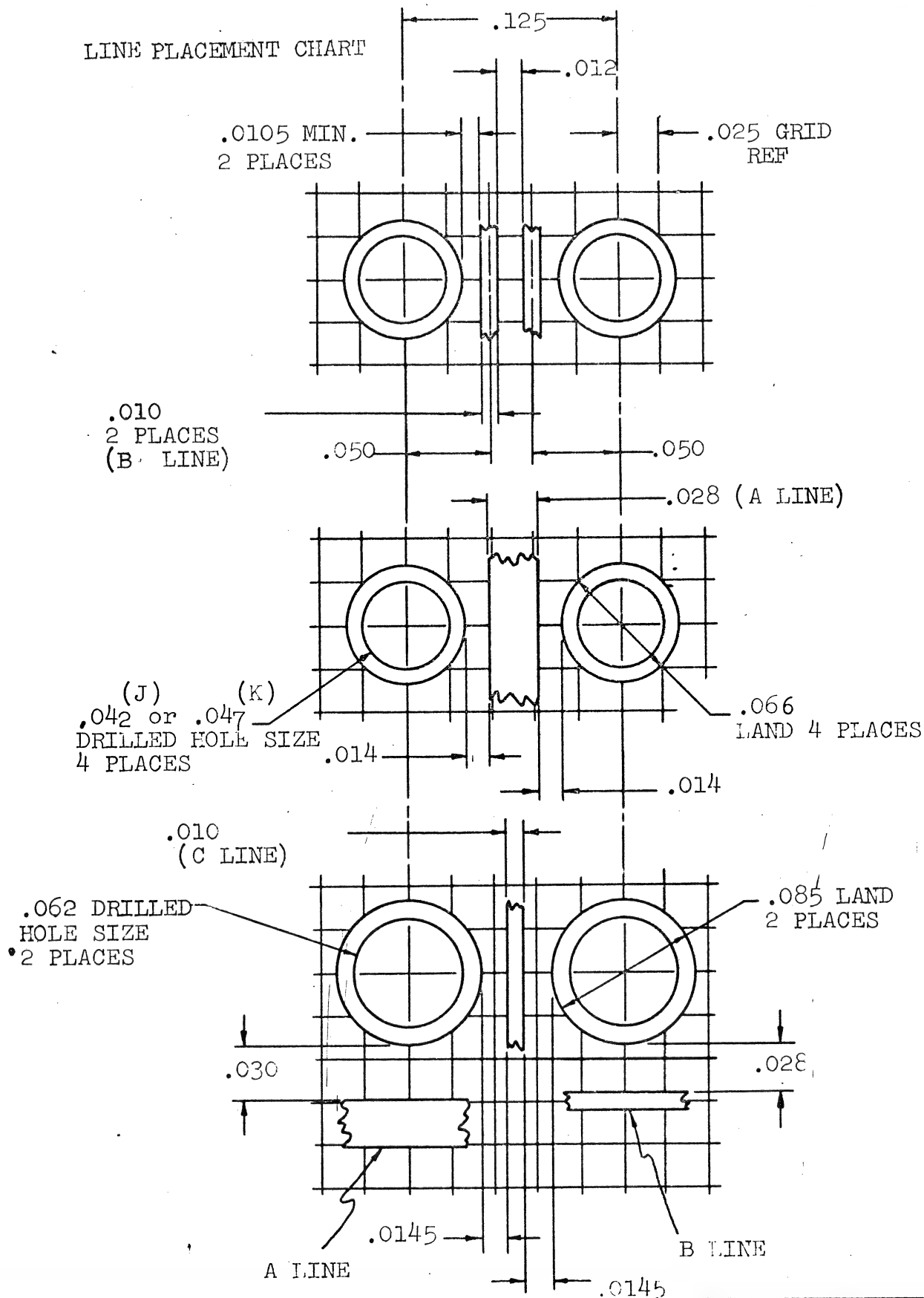
*Width	Direct Resist	Code	Use
.031	.028	A	Normal line placement centered between .025 grid.
" " " "		D E F G	Special use for 45° lines between J or K lands on the standard hole pattern - see CCDA wiring input rules.
.013	.010	B	Normal line placement on a .025 grid.
"		C	Special line placement centered between .025 grid.

*WIDTH Actual line widths are determined by the manufacturing process and meet the requirements stated in Engineering Specification 890911. Standard card line widths are .010 and .028 (Direct Resist).

If density requires it, a voltage or ground line may run through a row of unused standard hole positions. Signal lines should not run through an excessive number of these unused standard hole positions.

The Conductor width connecting to a card tab must not exceed .035 inches for a minimum linear distance of .060 inches. Refer to the following illustration.

The current carrying capacity of lines is included in Engineering Specification 811800.

RAW CARD REQUIREMENTS

LINE PLACEMENT CHART

HOLES AND LANDS

Hole and land sizes available for cards are shown in the following table. No hole sizes other than those shown may be used without prior concurrence from Dept. 146, Endicott.

The plated hole size limits for standard card panels processed through the direct resist process are 0.062". Any panels having holes (requiring plating) less than .026" in diameter will be coded "Special". They will require special off-line processing at additional cost (they require tin-lead as on etch resist).

Hole Dia Code	Location Tolerance	Drill Dia.	Plated Hole Diameter	Screw Size Clearance	Land Size
*M	± .002	.030±.001	.028±.002		.048+.001 dia.
**W		.033 ± .001	.031 ± .002		.066 + .001 dia.
BOARD		.035 ± .001	.031 ± .002		.050 + .001 sq.
J		.042 + .001	.040 ± .002		.066 + .001 dia.
K		.047 ± .001	.045 ± .002		.066 + .001 dia.
L		.062 ± .002	.060 ± .002		.085 + .001 dia.
NoteCode	Location Tolerance	.081 ± .002	.077 ± .002		.103 + .001 sq.
BA/BB	± .005	.096 ± .002	.092 ± .002	# 2	.153 + .001 sq.
		.125 ± .002	.121 ± .002	# 4	.153 + .001 sq.
		.1562 ± .002	.152 ± .002	# 6	.203 + .001 sq.
		.1875 ± .002	.184 ± .002	# 8	.253 + .001 sq.
		.201 ± .002	.197 ± .002	#10	.253 + .001 sq.
		.250 ± .002	.246 ± .002		.303 + .001 sq.

* Restricted to flat pack card only.
** Restricted to cards with program pins.

NOTES:
1. Holes can be drilled on 0.025 grids only.
2. Hole diameters in excess of 0.062 are generally used for clearance holes.
3. For specific input requirements for square lands, see CCDA Input Ground Rules, Suffix 4.

Hole Size Requirement

Component lead hole sizes are to be determined by the component lead diameters used. Refer to Ground Rules for specific components.

All via holes must be J size unless all holes on the card are L holes, then via holes can be L holes.

Plated Hole Tolerances

The plated hole diameter will be .004 less than the stated drill diameter and will have a plating tolerance of +.002 -.002 for drill hole sizes greater than .062.

Land to Hole Tolerances

Land diameters must be .015" minimum above the maximum drill diameter for plated through holes. Large lands may be produced for special holes. See the input requirements for CCDA.

Plated Hole, Land Requirement

A land on both the front and back surface must be specified on the card for each plated through hole.

Note Codes for Holes

Those holes that are required for clearance with no lands and no plating must be covered by note code BB on the raw card drawing or manual hole drawing.

BA - used for holes other than J, K, L, M, W or board holes that require plating (drill before plating).

BB - used for holes that are to be free of plating (drill after plating) with no lands.

AJ - the normal manufacturing process may or may not fill all plated holes with solder, therefore, if a plated hole is required to be free of solder for a design consideration, Note Code AJ must be specified. This note may be required if external assembly after initial manufacture is required.

SPACING

Input

The following chart lists the minimum allowable spacing between conductors, conductors and land, and between lands. Special requirements are noted in other sections of the ground rules and these supercede the values listed herein. If a card requires spacing not covered in the ground rules, contact the local ground rule representative for deviation approval.

Spacing between land centers:

Between .048 round lands	.100 inch
Between .066 round lands	.100 inch
Between .085 round lands	.125 inch
Between .066 and .085 round lands	.125 inch
Between .103 square lands	.150 inch
Between .153 square lands	.200 inch
Between .203 square lands	.250 inch
Between .253 square lands	.300 inch
Between .303 square lands	.350 inch

Between line edge and hole edges without lands .020 inch

Between all line edges and line edge to land edge .0105 inch

Between drill hole edges .044 inch.

Finished Card

The spacing requirements for finished cards are defined in Engineering Specification 890911.

COPPER AREA:

The difference in area of copper on the front side of the card with respect to the back must not exceed 15%. Differentials of less than 5% should be maintained if possible.

RESTRICTED AREAS:

The restricted areas are the areas reserved on cards for manufacturing requirements. Lands, holes, circuit lines, and components are not permitted in these areas, except as noted in the "Card Restricted Areas" illustrations.

The width of this restricted area is .040" along the top and bottom, and .047" on the left side of the card. An additional restricted area for components is .025" and lies between Y-19 and Y-20. Lands may not extend into the tab area of the card beyond .010" to the right of Grid Y-22. (.015" to the left of Grid Y-21). Therefore, .085 lands (L Holes) must not be located on or toward the right of Y23. Also there are special restricted areas at the card notch areas.

OUTERMOST STANDARD HOLE POSITIONS

LEFT

J OR K HOLE - Y124

L HOLE - Y123

1-12

X22

X79

2.960

J OR K HOLE - Y64

L HOLE - Y63

Y52

1-6

X23

X78

Y33

L HOLE - Y24

J OR K HOLE - Y23

BOTTOM

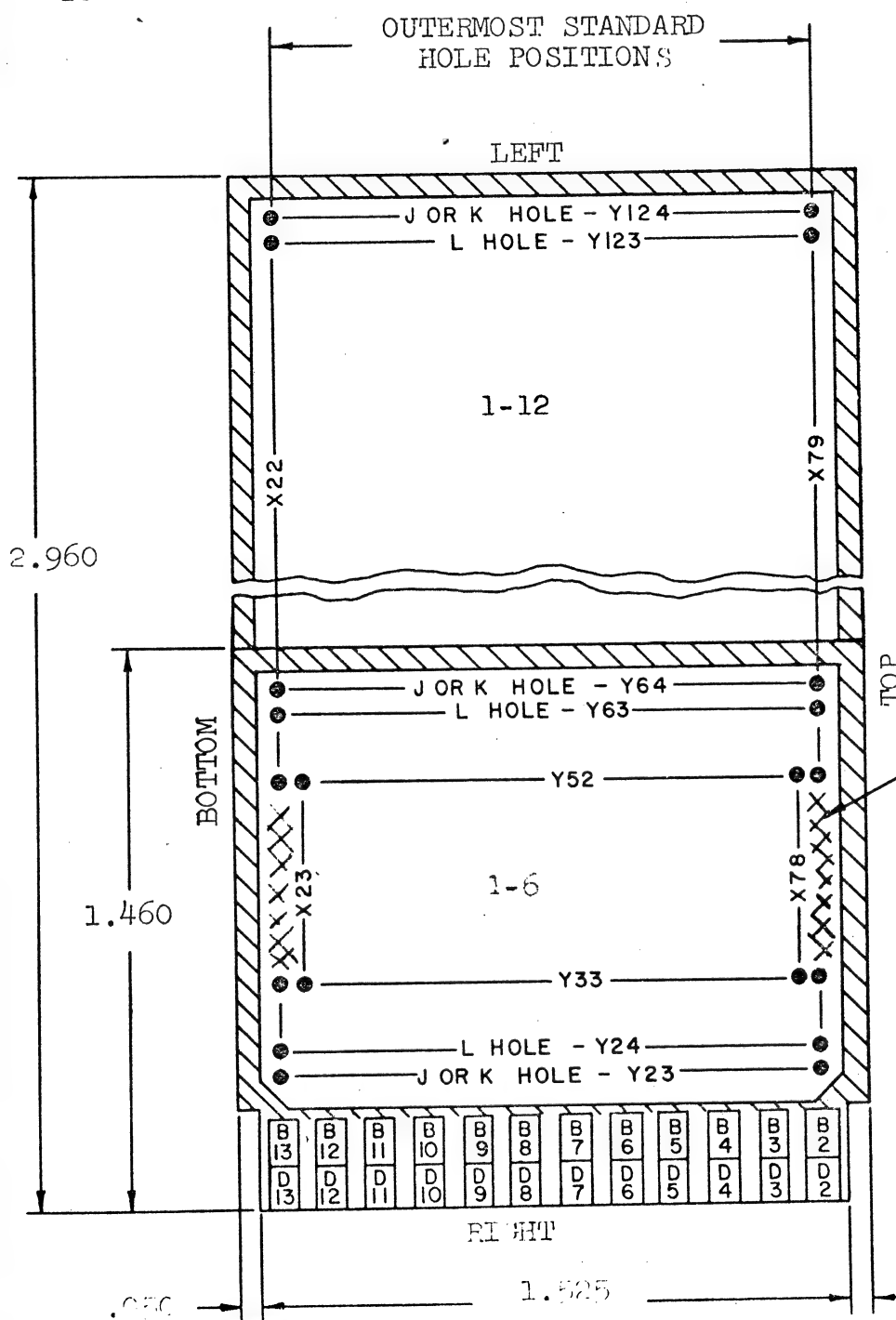
TOP

1.460

B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2

D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2

RIGHT

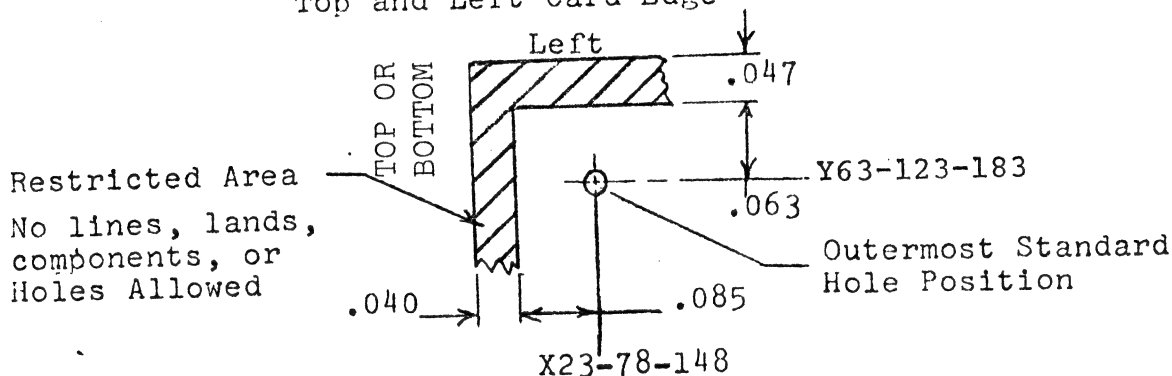
.050 1.525 .050

NOTE:

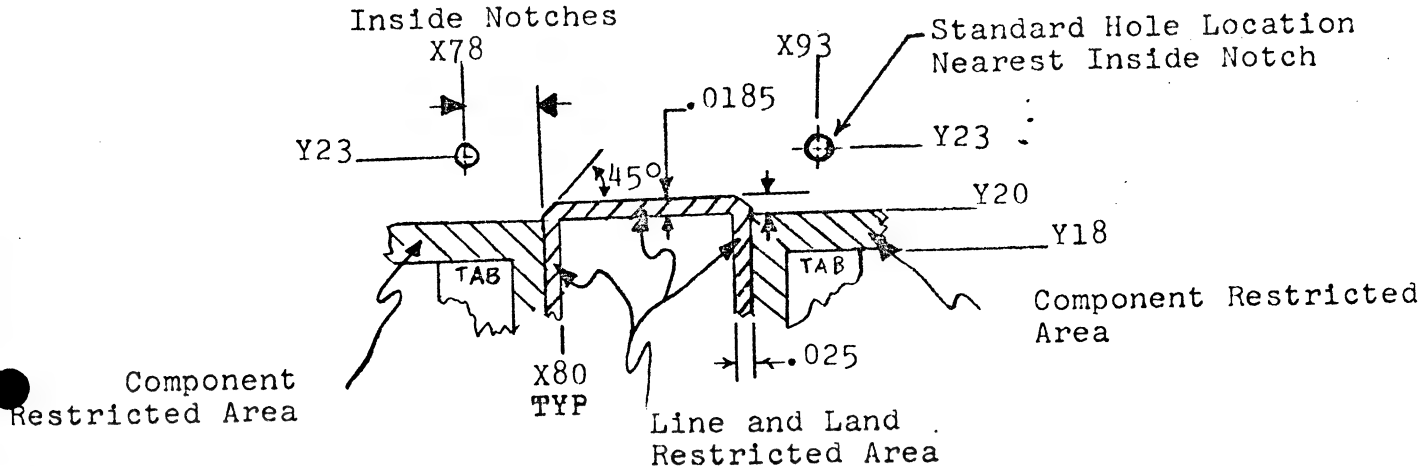
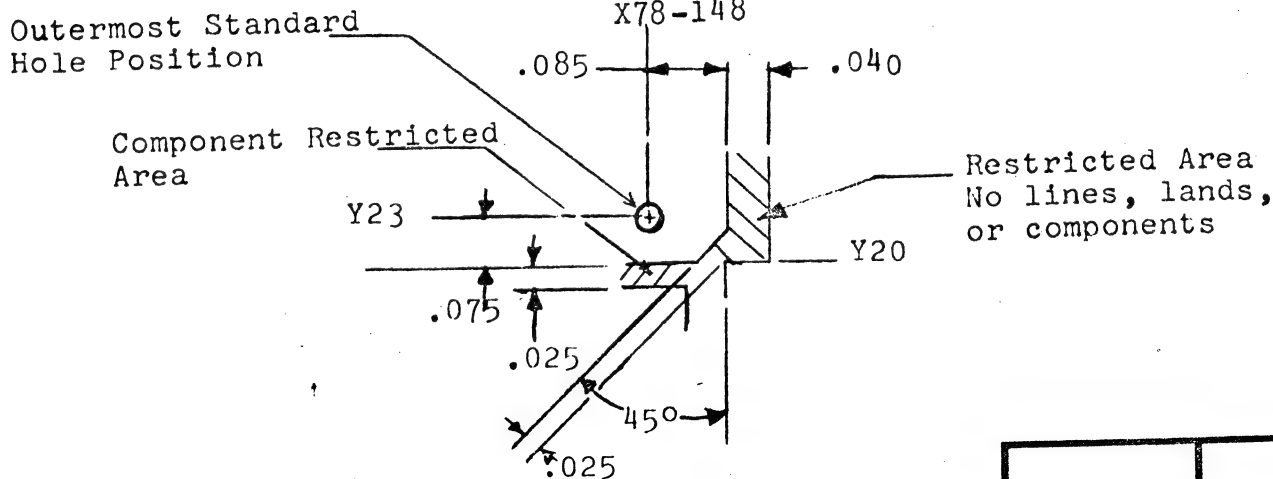
"J" HOLES FOR VIA USE ONLY ARE PERMITTED ON THE FOLLOWING GRIDS:
1Hi cards Y22 and Y64
2Hi cards Y22 and Y124

"J" and "K" via holes only are permitted in the following locations:
X22 - X79 between Y33 and Y52.

LINES AND LANDS MAY EXTEND INTO THIS AREA, COMPONENT LEADS ARE NOT PERMITTED

Restricted Area Around Bottom
Top and Left Card Edge

Left
TOP OR BOTTOM
.047
Y63-123-183
.063
Restricted Area
No lines, lands, components, or Holes Allowed
Outermost Standard Hole Position
.040
.085
X23-78-148

Restricted Area at
Inside Notches

X78
X93
Standard Hole Location Nearest Inside Notch
.0185
Y23
Y23
45°
Y20
Y18
TAB
TAB
Component Restricted Area
X80 TYP
.025
Component Restricted Area
Line and Land Restricted Area

Restricted Area At Outside Notch
X78-148

Outermost Standard Hole Position
.085
.040
Component Restricted Area
Restricted Area No lines, lands, or components
Y23
Y20
.075
.025
45°
.025

STEP AND REPEAT ALIGNMENT HOLE-LANDS:

To facilitate alignment of artwork registration during the step and repeat process the following J or K holes and lands must be on the raw card artworks whether or not they are used for component mounting or via holes.

One-socket cards

Card	Hole lands at
1-6 and 1-12	X23-Y23 X78-Y23

Two-socket cards

Card	Hole lands at
2-12 and 2-24	X23-Y23 X78-Y23 X148-Y23
2-36	X23-Y23 X78-Y23 X148-Y23 X23-Y183 X148-Y183

Three-socket cards

Card	Hole lands at
3-36	X23-Y23 X148-Y23 X218-Y23 X23-Y123 X218-Y123

Four-socket cards

Card	Hole lands at
4-48	X23-Y23 X148-Y23 X288-Y23 X23-Y123 X288-Y123

CONTACT SPRINGS-QUANTITY REQUIREMENTS:

All contacts are required for all card sizes.

CARD IDENTIFICATION

Identification that appears on the card surface will be on the printed circuit artwork and will be etched into the surface. Lettering height shall be 0.035 inch minimum.

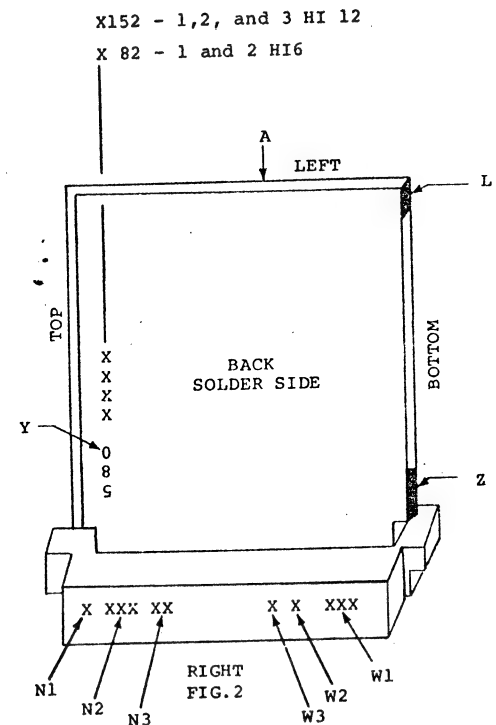
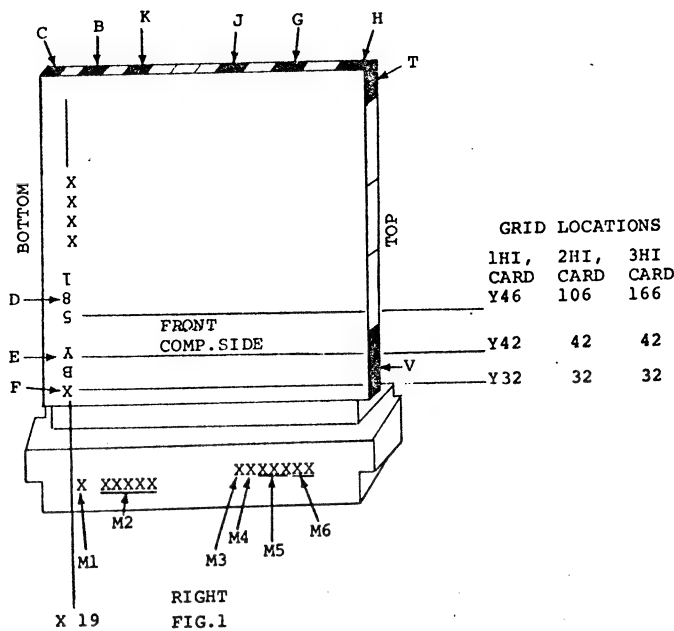
Location of part number identification varies according to date of manufacture. Grid coordinates shown below are approximate locations for manual artwork, use 140 template #3 pen.

The following figures illustrate the positions for finished card identification.

C B K J G H T
BOTTOM TOP
FRONT COMP.SIDE
D E F V
X XXXXX XXXXXXX
M1 M2 M3 M4 M5 M6
X 19
RIGHT FIG.1

GRID LOCATIONS

1HI, CARD	2HI, CARD	3HI CARD
Y46	106	166
Y42	42	42
Y32	32	32

X152 - 1,2, and 3 HI 12
X 82 - 1 and 2 HI6
A LEFT L
TOP BOTTOM
BACK SOLDER SIDE
Y Z
X XXX XX X X XXX
N1 N2 N3 W3 W2 W1
RIGHT FIG.2

LEGEND

A. Not Customer Shippable

B. .370 High Components

C. Initial Identification For Line or Field Return. (Owego).

D. Raw Card Part Number

E. Suppliers Code
Designates Plant that Manufactured Card

LEGEND (CONTINUED)

F. Engineering Change Level consists of alphabetic or numeric character.

G. Off Spec. Components

H. Unqualified Modules (Orange Mark)

J. Identification mark used by IBM, WTC to identify SLT cards that have limited Product Test support and may be subject to replacement.

K. Identification of cards having used components.

L. Line and Field return Endicott receiving.

M. 1. Qualification Code

2. Last 5 digits of Assembly No.

3. Assembly E.C. Level
1 alphabetic or numeric character

4. Year, 1 Digit

5. Production Assembly Date, 3 Digits
(Date Card ASM completed)

6. Suppliers Code
Designates plant performing card assembly.

N. Original Assembly Identification for ETN on MST.

1. Year Code

2. Production Assembly Date

3. Supplier Code

T. Tested Card Identification

Mark appears at corner for all card sizes, except those automatically marked, then it will appear as 1 High (6 Pack) level only.

V. Line or Field Return Test Mark

W. 1. Shop Date Code (Date Raw Card Asm. completed)

2. Alphabetic Character for Plant of Contact & Housing Assembly

3. Qualification Level of Raw Card

Y. Assembly Number

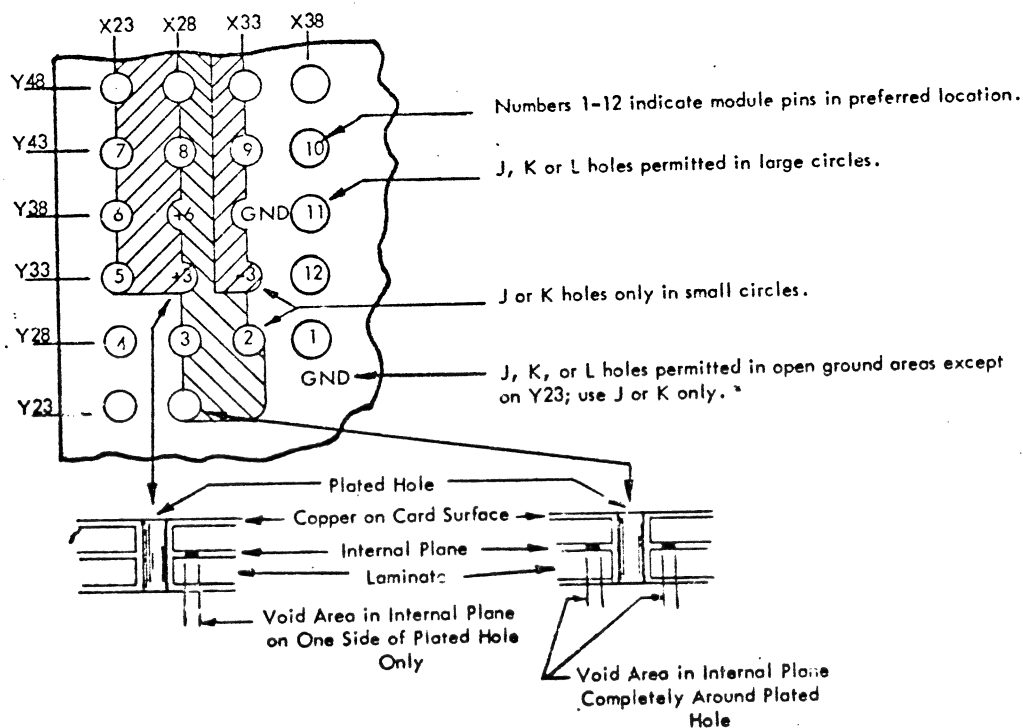
Z. Untested Card and System Functioned Card for Field Stock.

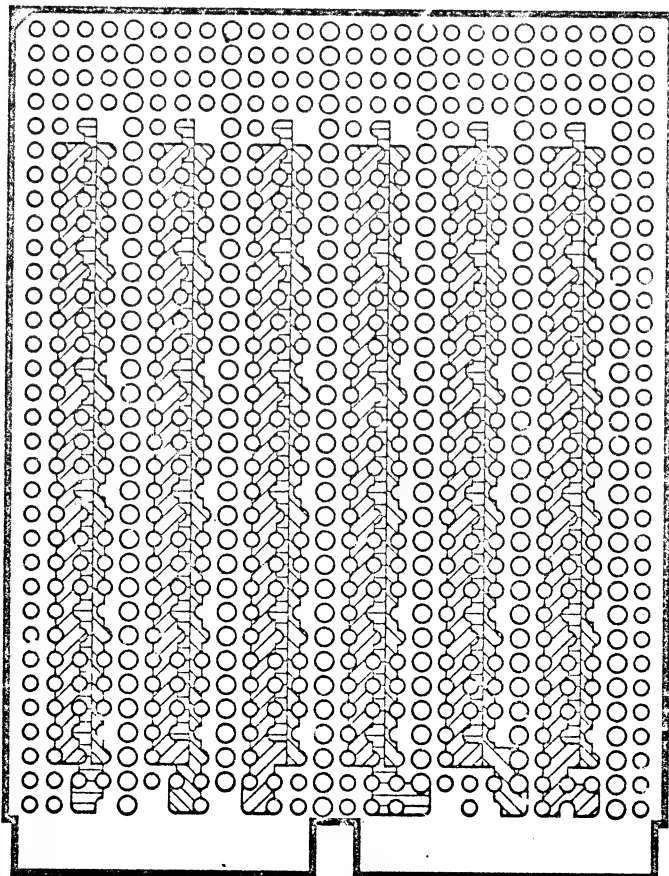
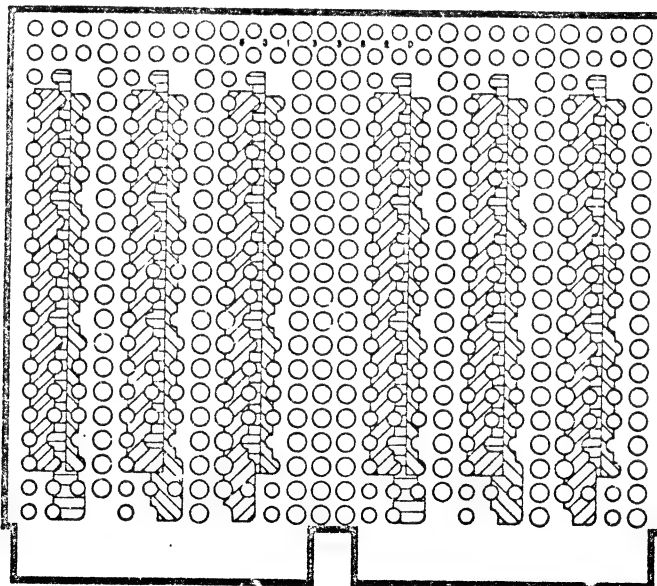
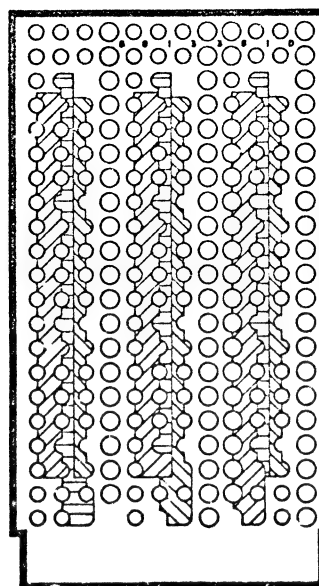
USAGE

Functional operation and/or packaging density may require that 2Hi and 3Hi cards contain an internal plane.

The internal planes must be wired to the appropriate card tabs which are located adjacent to the planes access points. These lines must be as short as possible.

INTERNAL PLANE DETAIL

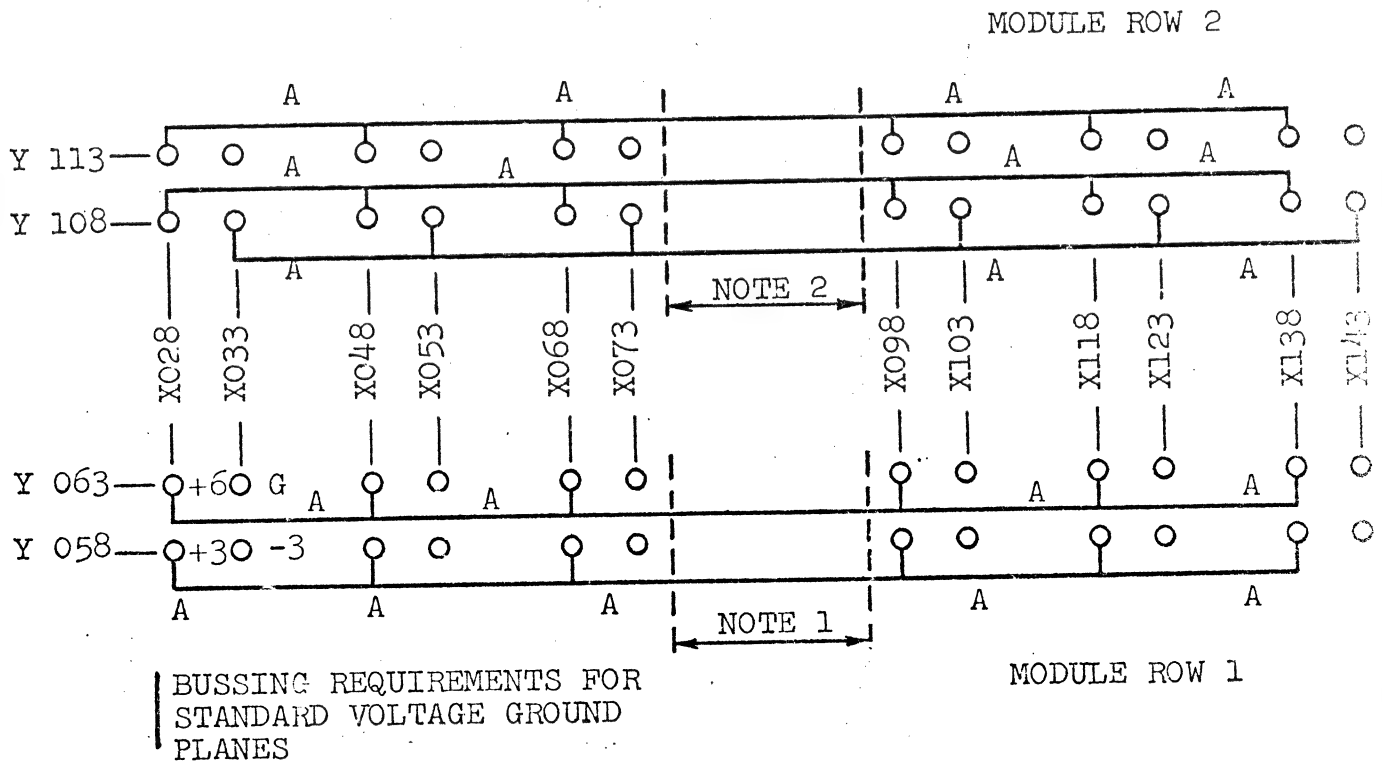
The following illustration shows a detailed section of the standard voltage ground plane. Hole sizes permitted apply to all standard voltage ground and ground planes.

STANDARD VOLTAGE AND GROUND PLANE

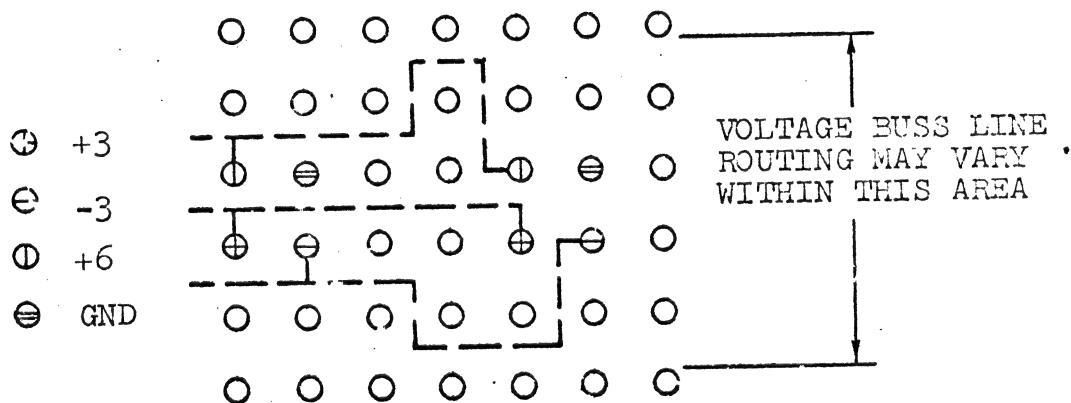
The standard voltage - ground plane provides Ground, +3, -3, and +6 volts. The following voltage ground planes are available:

3-Hi 12 - 811725

2-Hi 12 - 811072

2-Hi 6 - 811071

The large bulls eyes accept J, K, and L size holes. The small bulls eyes accept J and K size holes.

BUSSING

External Bussing between voltage planes is required on all cards using the standard Voltage Ground planes. The following figure shows the recommended bussing requirements for a 2Hi 12 card. Bussing should be the same on 2Hi 6 except for the interconnections between top and bottom of the card. Bussing requirement for 3-Hi 12 cards have not been defined. However, it is recommended that the rules for 2-Hi 12 cards be used as a guide.

BUSSING REQUIREMENTS FOR STANDARD VOLTAGE GROUND PLANES

Buss lines may be on either the front or back of the card. These lines do not have to follow the same path shown in the above figure but must be in the same module row. (See following figure)

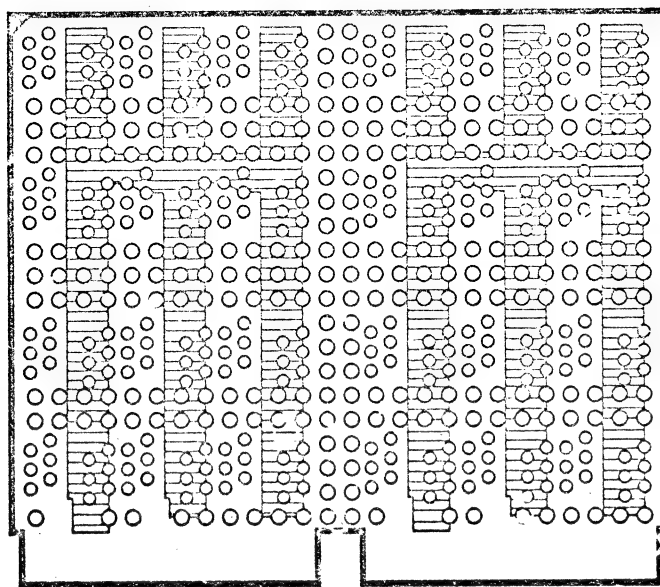
ALTERNATE BUSSING PATH

Should layout restrictions require removal of bussing, the following alternates can be used:

a. On 2Hi 12 cards the interconnections between the top and bottom of the card (Notes 1 and 2) may be left out.
b. All buss lines in module row four on 2Hi cards may be omitted with the Circuit Designers approval.

If a standard voltage is not being used, each of the voltage plane segments should be tied to ground. It is not necessary to tie a segment more than once.

The internal planes must be wired to the appropr[illegible]e card tabs which are located adjacent to the planes access points. These lines must be as short as possible.

14 LEAD FLAT PACK VOLTAGE GROUND PLANE

This plane contains ground and +6 volts. The plane must be wired to the appropriate card tabs which are located adjacent to the planes access points. These lines must be as short as possible. Bussing is not required.

813627

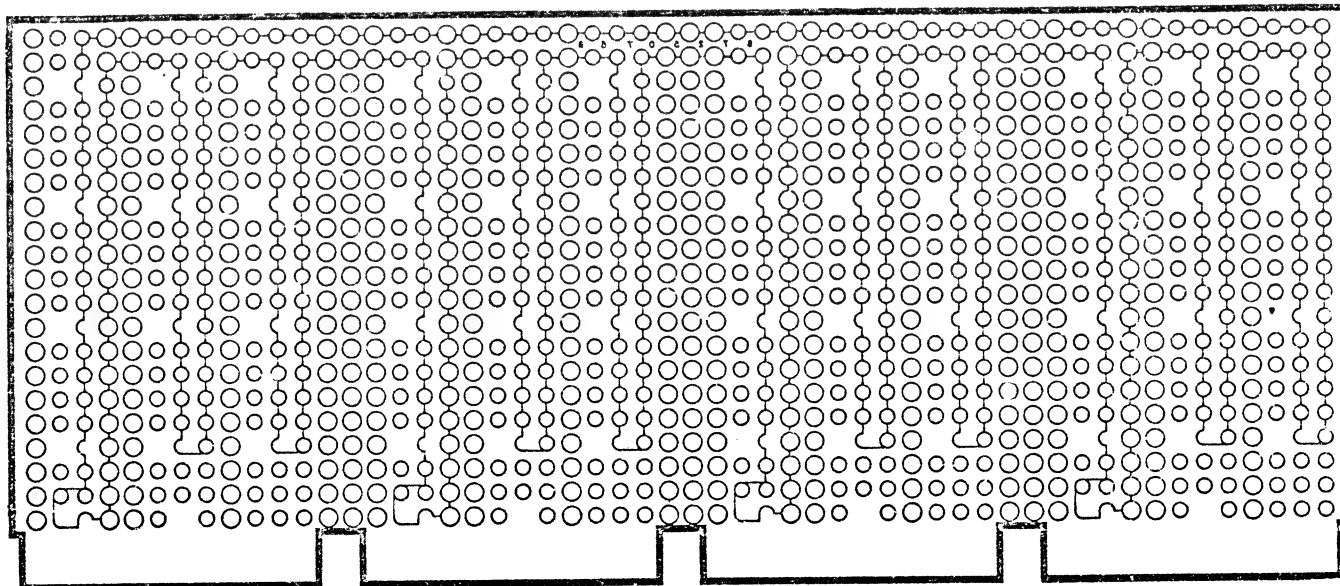
VOLTAGE GROUND PLANE
FOR 14 LEAD FLAT PAC CARDS

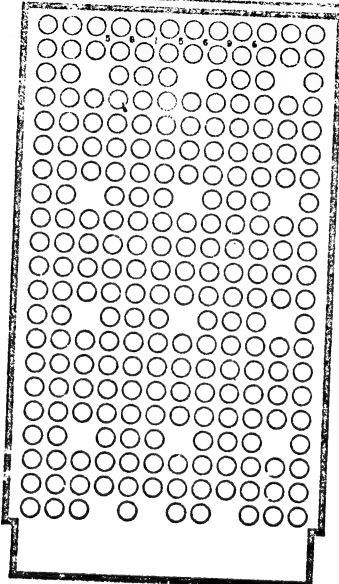
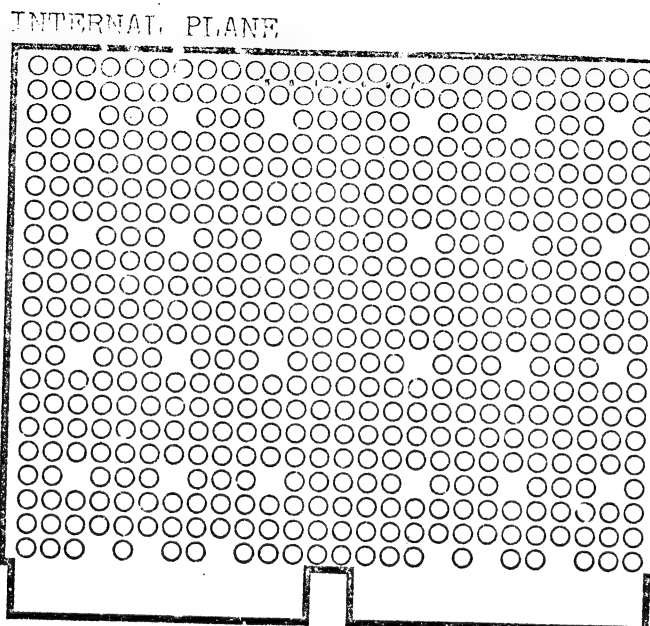
NOTE

The large bull's eyes will accept J and K size holes.

The small bull's eyes will accept M size holes only.

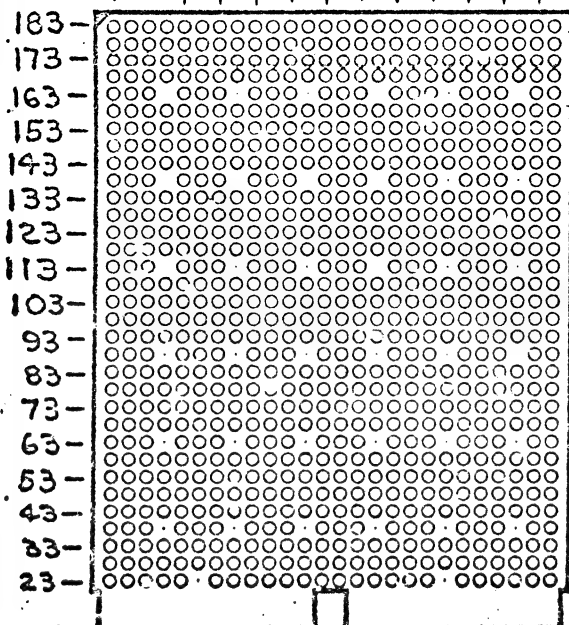
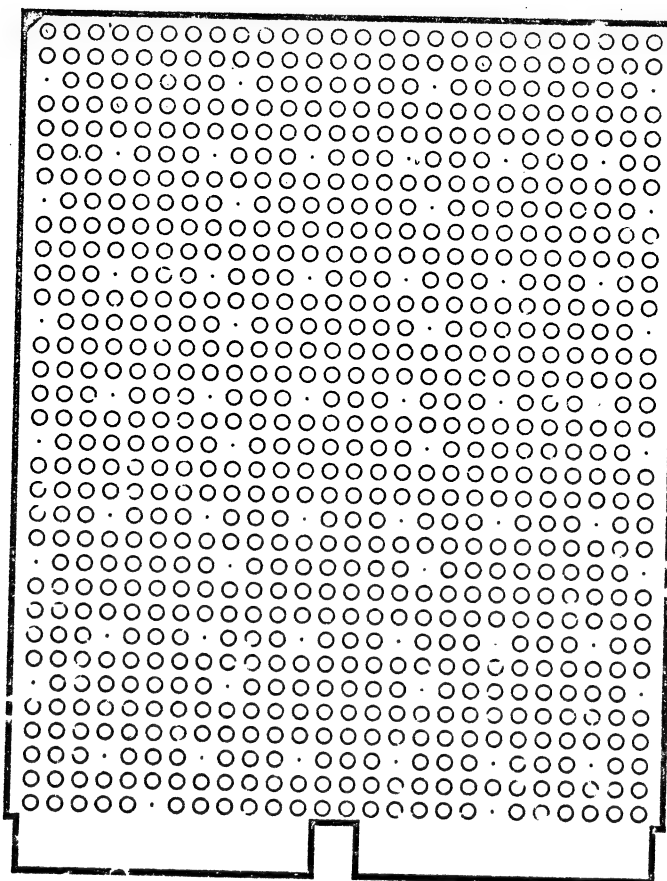
3 & 4 SOCKET VOLTAGE GROUND PLANE

Voltage ground planes for the 3 & 4 socket cards are not released. The plane shown in the following illustration is similar to the Standard voltage ground planes released for one and two socket cards. This plane contains 1 voltage and ground and is designed to accept SLD modules. Connections to access points are the same as for the standard voltage ground planes.

2-HI 24 EXPERIMENTAL VOLTAGE GROUND PLANE PART NUMBER S725075 B

INTERNAL PLANE

811813
2 Hi 6

2 Hi 12 811814

33 53 73 93 113, 133
23 43 63 83 103 123 143

183 – 173 – 163 – 153 – 143 – 133 – 123 – 113 – 103 – 93 – 83 – 73 – 63 – 53 – 43 – 33 – 23 –

3 HI 12 811697

811231
811811 3 Hi 12

NOTES:

WHITE AREAS ARE CONDUCTIVE

J, K, AND L HOLES ARE PERMITTED IN ALL STANDARD HOLE POSITIONS IN PLANES 811813, 811814, AND 811697 and 811811.

J AND K HOLES ARE PERMITTED IN ALL STANDARD HOLE POSITIONS ON PLANE 811231 and 811230.

STANDARD GROUND PLANES

Standard ground planes are available for 2 Hi 6, 2 Hi 12, and 3 Hi 12. Bussing is not required for these cards. These planes will accept J, K, and L holes in all standard hole positions. The ground connections are available in the same locations as on Standard voltage ground planes. The following internal ground planes are available.

2-Hi 6 - 811813
2-Hi 12 - 811814
3-Hi 12 - 811697

NON-STANDARD PLANES

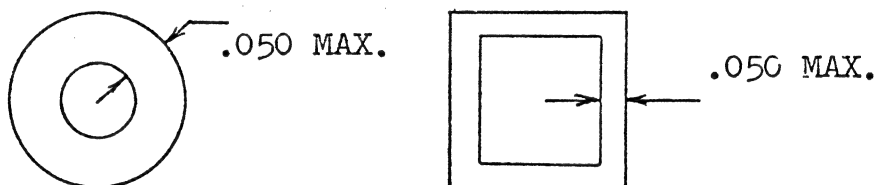
Non-Standard planes may be permitted when a card can be layed out in no other way. All cards requiring these planes must be reviewed by Department 146, Endicott before release.

Each plane must show the following basic information:

Bull's eye location
(see instructions for dimensioning on .125 grids pattern
see instructions for dimensioning off .125 grids pattern)

Bull's eye dimensions used on the plane
(see Detail A & B in the illustration titled "Dimensioning Requirements for off .125 grid pattern plans")

NOTE: When laying out internal planes, it is necessary to maintain a .050" maximum copper free area for each "bull's eye". This requirement is necessary to prevent delamination.

.050 MAX.   .050 MAX.

End View Drawing
(See Section A-A in the illustration titled "Dimensioning requirements for off .125 grid patterns planes")

NOTES

All of the following notes must appear on the plane drawing.

X Basic Grid Pattern at .025 spacing.

XI Composite consists of core sheet made of 19-701 material, a face sheet made of 19-702 material and a pre-pregnated epoxy sheet in between. All bonded to form a laminate.

XII Dark areas to be free of copper.

XIII Original artwork to be furnished by IBM under part number ______________.

XIV Must conform to Engineering Specification 890910.

XV Alignment and registration of artwork to be within .004 from X-X and Y-Y.

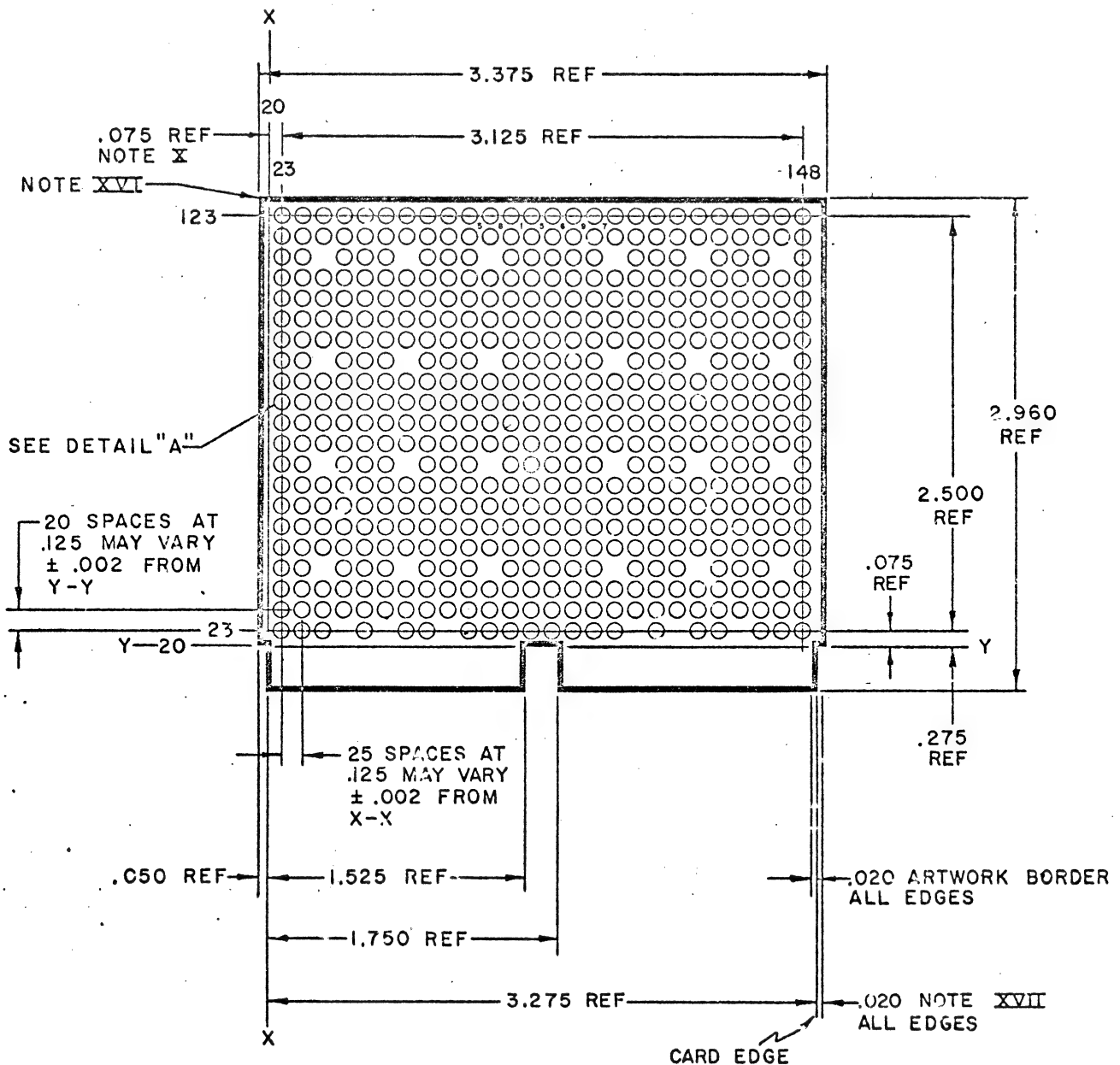
XVI Clip mark to appear in upper left hand corner on module side of core sheet.

XVII Artwork border extends beyond card edge .020 for manufacturing purposes only.

The title of the plane drawing shall read "Circuit Card Composite 2-Hi 6 - See B/M" (2-Hi 12, etc.)

DIMENSIONING REQUIREMENTS FOR PLANES USING .125" SPACING

Below is an example of dimensioning for standard .125" spacing planes. Only view A-A is shown here. On an actual drawing the end view, Bull's eye dimensions, and notes must be included.

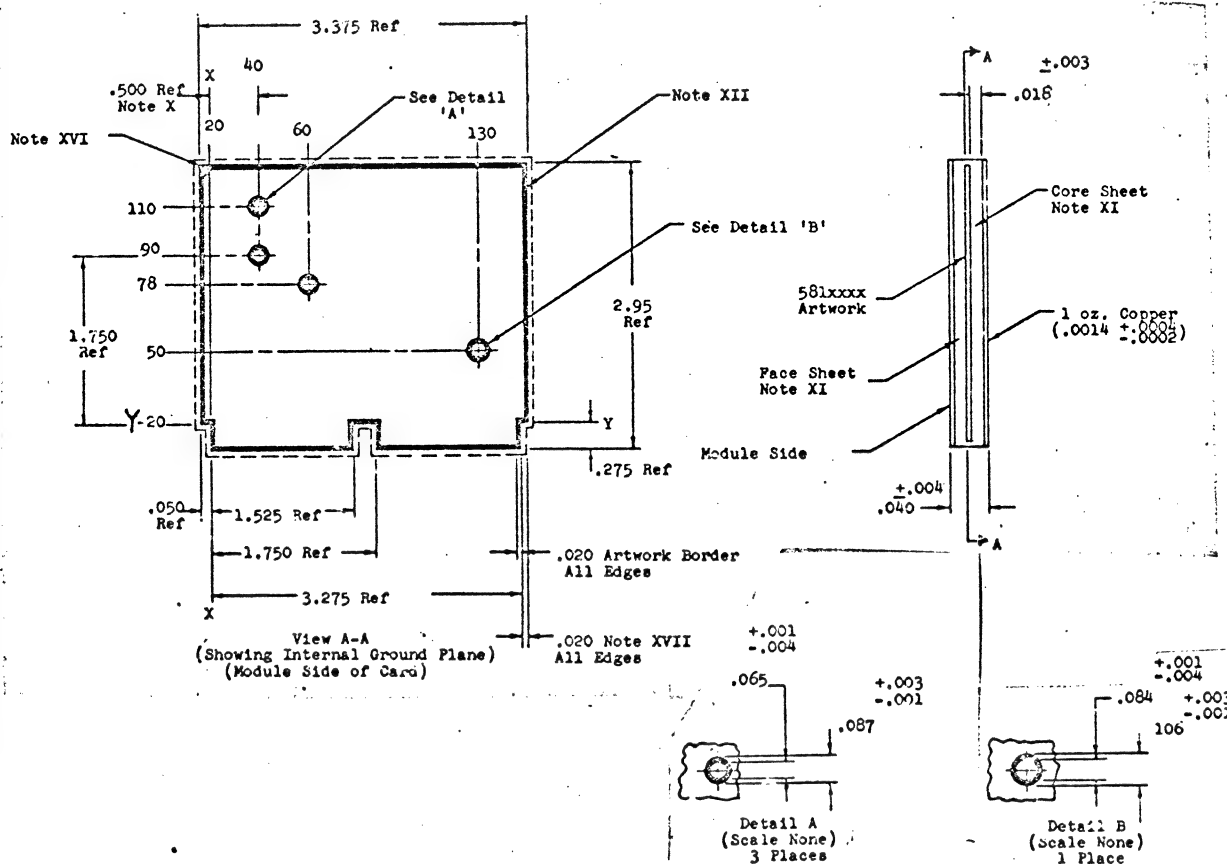
X
3.375 REF
20
.075 REF
NOTE X
3.125 REF
23
148
NOTE XVI
123
SEE DETAIL "A"
2.960 REF
2.500 REF
20 SPACES AT .125 MAY VARY ± .002 FROM Y-Y
.075 REF
23
Y—20
Y
.275 REF
25 SPACES AT .125 MAY VARY ± .002 FROM X-X
.050 REF
1.525 REF
.020 ARTWORK BORDER ALL EDGES
1.750 REF
3.275 REF
.020 NOTE XVII ALL EDGES
X
CARD EDGE

VIEW A - A
(Showing Internal Ground Plane)
(Module Side of Card)

INSTRUCTIONS FOR DESIGNING NON-STANDARD HOLE PATTERN PLANES

Sample Drawing Title:

Circuit Card Composite - 2-Hi 6-See B/M (2-Hi 12, etc.)

Dimensioning Required for Planes Using other than .125 Grid Pattern

Shown below is an example of the information required on a special internal plane drawing. Notice that the card outline dimensions are marked REF. Detail "A" is the standard bull's eye and clearance for a J or K size hole. Detail "B" is the standard bull's eye and clearance for a J, K or L size hole. The hole nearest X-20 (starting hole) should be dimensioned from X-20 and Y 20. The remaining holes are located by the grid only, on a completely random pattern.

DIMENSIONING REQUIREMENTS FOR OFF .125 GRID PATTERN PLANES

CHANGES TO INTERNAL PLANES

Each change to an internal plane requires a new composite part number (81XXXX) except experimental cards. The 581XXXX artwork number remains the same but is updated by a level letter, A, B, etc. This level letter must be included in the equivalent of Note XIII as well as on the end view of the drawing.

1. Experimental composite drawings retain the original part number.

2. DV and formal released composite drawings:

   a. Mark a brownline of the current composite drawing "OBSOLETE"; do not add "Replaced by________________".

   b. Correct the master composite drawing under a new part number. Order formal released master drawings from Department 146 Endicott. Document the order by memorandum to Mr. C. W. Carlson, Department 446 Endicott.

3. All affected raw card drawings must be updated to the new composite part number. These raw card part numbers may be obtained from Department 146 Endicott.

4. The composite drawing part number is not changed when the disposition is "use as is" or the artwork is not affected.

WIRING RULES

Recommended practices for layout of all noise sensitive cards:

a. To greatly reduce noise sensitivity use an internal plane to isolate front and back artworks.

b. Allow as much distance as possible between signal lines.

c. When locating noise sensitive lines, the following should be considered:

(1) Internal plane not used: Front and/or back artwork wiring should not be located near components with large amounts of electrically functional metal in their composition, e.g., capacitors, inductors, reed relays and wire wound resistors.

(2) With an internal plane: Only back artwork wiring in the direct vicinity of components with large amounts of electrically functional metal in their compositions is allowable.

Recommended Practices For Layout of Sense Amplifiers:

a. Adhere to the practices as listed for all noise sensitive cards.

b. Place as much distance as possible between inputs and outputs.

1. Inputs should be grouped.

2. Outputs should be grouped.

3. An internal plane will provide the required shielding to allow placing input and output lines directly opposite one another in a front to back artwork relationship.

c. If more than one sense amplifier is packaged on a single card, individual sense amplifier components should be grouped and isolated as much as possible from one another.

d. Minimize all voltage and ground line runs (.031 external artwork).

WIRING RULES

All SLT cards Must be laid out in accordance with the following rules.

5 and 30 N.S. Card Wiring Rules:

Voltage Ground Lines

a. Must be .031 inches wide.

b. May be run parallel to each other on opposite sides of the card (back to back) with or without internal planes.

c. Service voltage lines must be less than 3 inches long. This is from one end of the line to the tab.

d. May run through unused hole positions when using a standard hole pattern but should be avoided.

Signal Lines

a. Must be .013 inches wide.

b. Avoid running on adjacent .025 inch grids.

c. If lines must run on adjacent .025 inch grids, the following rules apply:

1. Do not exceed three inches if the lines do not connect to tabs.

2. Do not exceed one and one-half inches if the lines connect to tabs.

d. May be run parallel to each other on opposite sides of the card (back to back) if an internal plane is used.

e. May be run parallel to each other on opposite sides of the card (back to back) for not more than 3 inches if no internal plane is used.

f. May not run through more than five unused hole positions when a standard hole pattern is used, avoid running lines through unused standard hole positions if possible.

g. Ground leads must fan out from the first via hole and no more than one emitter may be connected to a single ground lead when a 1 Hi card with no internal plane with ground is used. On densely packed cards, two emitters in the same module may share the same ground branch.

Voltage, Ground and Signal Lines

Signal lines must not be run parallel on opposite sides of a card (back to back) with the service voltage or ground lines if no internal plane with ground is used. An exception to this rule is: The -3 volt line may be run parallel with a signal line for a length not to exceed one and one-half inches.

Standard Voltage Pin Positions For 5 and 30 Nanosecond Cards

+3	D03	J03
-3	B06	G06
+6	B11	G11
GND	D08	J08

700 N.S. Card Wiring Rules:

Voltage, Ground Lines

a. Must be .032 inches wide.

b. May be run parallel to each other on opposite sides of the card (back to back) with or without internal planes.

c. Service voltage lines must be less than 6 inches long. This is from the end of the line to a tab.

d. May run through unused hole positions when using a standard hole pattern but should be avoided.

Signal Lines

a. Must be .013 inches wide.

b. Avoid running on adjacent .025 inch grids.

c. If lines must run on adjacent .025 inch grids, the following rules apply:

   1. Do not exceed 6 inches if the lines do not connect to tabs.

   2. Do not exceed 3 inches if the lines connect to tabs.

Signal Lines -

d. May be run parallel to each other on opposite sides of the card (back to back) if an internal plane is used.

e. May be run parallel to each other on opposite sides of the card (back to back) for not more than 6 inches if no internal plane is used.

f. May not run through more than five unused hole positions when a standard hole pattern is used. Avoid running lines through unused standard hole positions if possible.

g. More than 4 emitters connected to one ground line should be avoided. The ground fan out should be from the first via hole above the tab.

Voltage, Ground and Signal Lines

Signal lines must not run parallel on opposite sides of the card (back to back) with the service voltage lines, or ground lines, if no internal plane is used.

Internal Plane

Do not use an internal plane unless packaging density requires it.

Standard Voltage Pin Positions For 700 N.S. Cards

+12	D03	J03	
OPEN	B06	G06	(Do not use either pin for signal line)
+12 M	B11	G11	
GND	D08	J08	

SCOPE

Decoupling is required for 5, 30, and 700 nanosecond cards as defined in Engineering Instruction Criteria & Ground Rules 811800. Compliance with this section will satisfy the requirements of Engineering Instruction and Criteria 811800.

For decoupling 3-hi cards, cards with discrete transistors, and cards with FTX modules, or cards with special modules these decoupling rules can be used as a guide for specific instructions. (See the job requestor). If a card has discrete components other than transistors, apply these rules by considering only the modules as if the discretes were not contained on the card at all.

Use R/C module 2414883(.68UF) located on grid row Y-23 for decoupling.

DECOUPLING NOTES

Each card assembly drawing must contain one of the following notes. If note code "AG" is used Engineering Specification part number 811800 must be added to the card assembly bill of material.

Note Code (AG) -

Card conforms to decoupling requirements in 811800. All 1-hi and 2-hi cards with only modular components or with modular and discrete components (excluding discrete transistors) that are adequately decoupled per the rules in Eng. Spec. 811800.

Note Code (AH) -

Card does not conform to decoupling requirements in 811800. All 1-hi and 2-hi cards with only modular components or with modular and discrete components (excluding discrete transistors) must have circuit designers approval before receiving this note code. Approval is to indicate that the designer can tolerate the noise factor, which is a little higher than allowed for most cards.

Note Code (AK) -

Card has been decoupled. 811800 is not applicable. All 3-hi cards that have been decoupled per job requestor, and all 1-hi and 2-hi cards with discrete transistors that are decoupled per job requestor.

Note Code (AL) -

Cards have not been decoupled. 811800 is not applicable. All 3-hi cards that have not been decoupled per job requestor, and all 1-hi and 2-hi cards with discrete transistors that have not been decoupled per job requestor.

REQUIREMENTS

Decoupling outlines the voltage decoupling requirements for the various circuit families in SLT packaging. Values given are for worst case conditions and any lesser values for other than worst case conditions shall be determined by the user group for each individual application. In all cases, that amount of circuit decoupling shall be used which will assure that the power distribution system tolerances will not be exceeded.

These rules cover the requirements for single socket 1 and 2 hi cards. For wider cards each socket position must be considered separately.

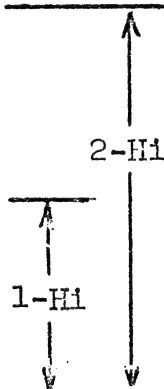
WEIGHT FACTORS

Assignment of decoupling capacitors for cards are determined by type and number of modules used and the location of the modules used. Two weight factors. "A" and "B" are used in determining this requirement.

"A" Weight Factor -

Weight factor "A" is assigned to each module position on the card as shown below.

"A" FACTOR VALUES

5 nsec			30 nsec				700 nsec family		
7.5	7.5	7.5	7.5	7.5	7.5	2-Hi	60	60	60
7.0	7.0	7.0	7.0	7.0	7.0	2-Hi	50	45	50
6.5	6.5	6.5	6.5	6.5	6.5	1-Hi / 2-Hi	40	30	40
6.0	6.0	6.0	6.0	6.0	6.0	1-Hi / 2-Hi	25	15	25

Section 5 Decoupling

Weight factor "B" for standard modules may be found in the following "B" factor table.

"B" FACTOR TABLE

P/N	NAME	B-FACTOR	FAMILY (nsec)
361404	AOI	6	5
361406	AOI	6	5
361407	AOI	6	5
361408	AOI	6	5
361410	AOI	6	5
361412	AOI	6	5
361413	AOI	6	5
361427	TLR$_2$	6	30
361441	AOI	6	5
361442	AI	5	5
361443	AOI	6	5
361444	AOI	6	5
361445***	AOI	1	700
		2	
361451	AI	2	30
361453	AOI	3	30
361454***	DCI	10	30
		20	
361468	AOI	6	5
361473	API	5	30
361475***	HPD	16	30
		32	
361476***	LSA	2	5
		4	
361477	XOR	6	30
361479***	II	3	30
361489	XORL	6	30
361492*	APOI-AI	5	30
		2	700
		1.5	
361493*	AOI-AI	1	700
		1	
361494	DCI-II	(See special note for this module)	700

Notes:

*If pin I is used the first B factor applies.
If pin I is not used the second B factor applies.

***If one circuit is used, the first B factor applies.
If two circuits are used, the second B factor applies.

Special Note for Module 361494

The "B" factors for module 361494 are dependent on its application. The "B" factors required are selected from the following table by comparing the "allowable pin combinations" with those actually used. The use of pins other than 1, 5, 6, 11, and 12 do not affect the "B" factor selection.

DECOUPLING SECTION 5

POSSIBLE PIN COMBINATIONS			MODULE USE	"B" FACTOR
1	6		One II	B Factor for G or L (1)
1,5	6,11	6,12 6,11,12	One II and one DCI	B Factor for G (5.5) B Factor for L (1) for the II Circuit B Factor for L (4.5) for the DCI Circuit
1,6			Two II's	B Factor for G (2) B Factor for L (1) for each II Circuit
5	11	11,12 12	One DCI	B Factor for G or L (4,5
5,11	5,12	5,11,12	Two DCI's	B Factor for G (9) B Factor for L (4.5) for each DCI Circuit

Only one decoupling capacitor for each voltage is required per socket position.

SPECIAL DECOUPLING RULES FOR 5 and 30 N.S. CARDS

Cards with line Terminator Modules -

+3V decoupling is required on all cards with two or more LINE TERMINATORS (LTN). Determine decoupling requirements for the remaining voltages.

The line terminator resistor pac may be physically located on one half of a 2 wide card when its voltage pin is located on the other half. The card half with the voltage pin involved is the side that should be decoupled.

Cards with line Sense Amplifier Modules -

+6V decoupling is required on all cards with two or more line sense amplifier (LSA) Modules when all circuits driven by the LSA's are on the same card. It is recommended that LSA circuits be located near the card pins and that there input lines not exceed 2 inches.

Cards with AOI_{II} Modules -

All voltages must be decoupled when AOI_{II} Modules are used.

Calculations Required -

C Factor -

A value "C" is obtained to determine the number of decoupling capacitors required. This value is derived by adding the products of the "A" and "B" factors for each module position.

$$C = \sum_{N} A_n B_n$$

n = One of the occupied "A" factor positions

N = The number of occupied "A" factor positions

Voltages Requiring Decoupling -

The voltages to be decoupled are determined by comparing the value "C" with the following table.

"C" FACTOR TABLE

$C \leq 100$	No decoupling needed.
$101 \leq C \leq 200$	+3 volts requires decoupling
$201 \leq C \leq 300$	+3 and +6 volts require decoupling
$300 \leq C$	See Note 1
$301 \leq C \leq 350$	5 nanosecond family; +3. +6, -3 volts require decoupling
$350 \leq C$	See Note 1

C Factor Table Notes -

1. Components must be positioned in such a way that C does not exceed or is less than 300 for 30 n.s. cards or C doesn't exceed or is less than 350 for n.s. cards. If the card cannot be laid out without exceeding these limits, the cards originator must be contacted.

2. If the decoupling of a mixed circuit card involves any 5 n.s. "B" factors, the 5 n.s. "C" factors should be applied to the card.

Example of Decoupling Calculations for 5 and 30 n.s. cards -

Step 1 Assign temporary positions to modules as below

		361451
		361451
361451	361453	361473
361479	361454	361473

Step 2 Select the appropriate "A" factors for the positions assigned.

		361451 A=7.5
		361451 A=7.0
361451 A=6.5	361453 A=6.5	361473 A=6.5
361479 A=6.0	361454 A=6.0	361473 A=6.0

Step 3 Obtain the corresponding "B" factor from the "B" factor table for each module used.

		361451 B=2 A=7.5
		361451 B=2 A=7.0
361451 B=2 A=6.5	361453 B=3 A=6.5	361473 B=5 A=6.5
361479 B=6 A=6.0	361454 B=20 A=6.0	361473 B=5 A=6.0

Step 4 Compute "C" factor

$$C = \sum_N A_n B_n$$

$$C = A_1 B_1 + A_2 B_2 + A_3 B_3 + A_4 B_4 + A_5 B_5 + A_6 B_6 + A_7 B_7 + A_8 B_8$$

$$C = 2 \times 7.5 + 2 \times 7.0 + 5 \times 6.5 + 5 \times 6.0 + 3 \times 6.5 + 20 \times 6.0 + 2 \times 6.5 + 6 \times 6.0$$

$$C = 15 + 14 + 32.5 + 30 + 19.5 + 120 + 13 + 36$$

$$C = 280$$

Step 5 Compare the factor computed with the "C" factor table The "C" factor value of 280 falls between 201 or 300 therefore the voltages requiring decoupling are +3 and +6.

[SPE]CIAL RULES FOR 700 N.S. CARDS

Calculation -

The values G and L are obtained to determine the number of decoupling capacitors required.

G Factor - the electrical noise at the ground via hole is referred to as "G"

G is equal to the summation of all "B" factors for one socket position times 6.

$$G = 6\sum_{N} B$$

L Factor - The electrical noise voltage (L) induced on each ground line fanning out from the ground via hole is determined by the following:

L is equal to the product of the number of circuits connected to the branch minus 1, divided by the number of circuits connected to the branch* and the summation of the products of "A" times "B" for each circuit connected to the branch.

$$L = \frac{(J-1)}{J}\sum_{J} A_i B_i \qquad (1 \le J \le 4)$$

J is equal to the number of circuits connected to the branch.

I is equal to one of the circuits connected to the branch.

*Note: A branch is illustrated in the following figure.

DECOUPLING ILLUSTRATION

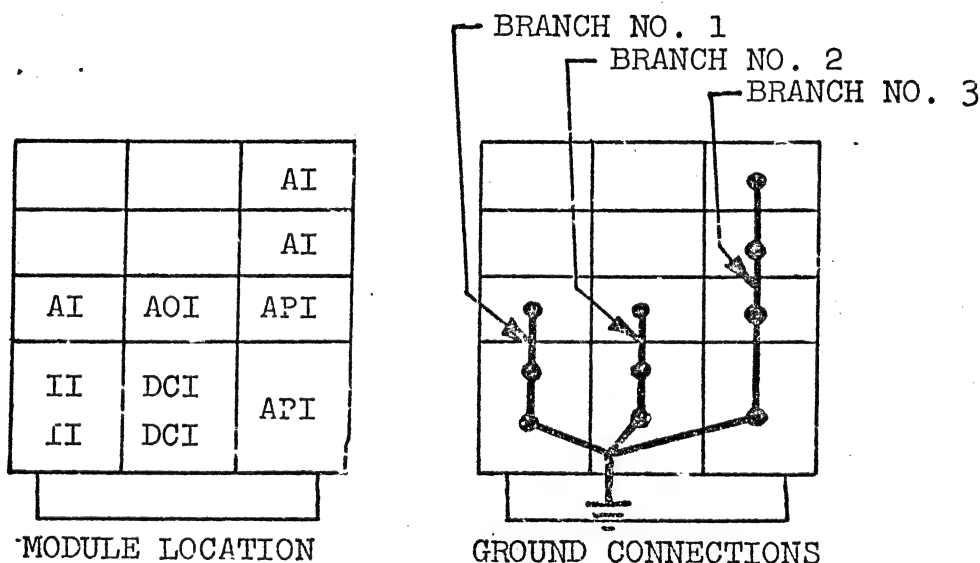
		AI
		AI
AI	AOI	API
II II	DCI DCI	API

MODULE LOCATION

BRANCH NO. 1

BRANCH NO. 2

BRANCH NO. 3

GROUND CONNECTIONS

EACH DOT REPRESENTS AN INDIVIDUAL EMITTER CONNECTION TO THE GROUND BRANCH

Derivation -

The L factor can be derived by inserting the appropriate values for "A" and "B" factors into the following equations.

one emitter circuit per branch L = 0

two emitter circuits per branch $L = \frac{1}{2} \quad (A_1B_1) + (A_2B_2)$

three emitter circuits per branch $L = 2/3 \quad (A_1B_1) + (A_2B_2) + (A_3B_3)$

four emitter circuits per branch $L = 3/4 \ (A_1B_1) = (A_2B_2) + (A_3B_3) + (A_4B_4)$

Note - No more than 4 emitters per branch are permitted.

The voltages to be decoupled are determined by comparing the values of "G" and "L" with the following tables.

Voltages Requiring Decoupling Without Internal Planes -

Decoupling requirements for 700 n.s. cards without internal planes.

$G \leq 200$ No decoupling required and $L \leq (200-G)$ for each branch

$201 \leq G \leq 400$ + 12 volts requires decoupling and $L \leq (200 - 1/2G)$ for each branch

$G \geq 401$ contact the cards originator

NOTE: When L is in excess of the required value an additional branch must be provided.

Voltages Requiring Decoupling With Internal Planes -

Decoupling requirements for 700 n.s. cards with internal planes.

G FACTOR TABLE

G	Decoupling
$G \leq 200$	No decoupling
$201 \leq G \leq 400$	+12 volts decoupled
$401 \leq G \leq 500$	+12 and + 12 volts decoupled

Example of Decoupling Calculations for 700 N.S. Cards -

Step 1 Assign temporary positions to modules.

		361493
		361493
361493	361493	361492
361494	361494	361492

Step 2 Select the appropriate "B" factors for the module used.

		361493 B=1
		361493 B=1
361493 B=1	361493 B=1	361492 B=1.5
361494 B=2 Used as Two II's.	361494 B=9 Used as Two DCI's.	361492 B=1.5

Step 3 Compute the "B" factor.

$$G = 6\sum_N B$$

$$G = 6\ (B_1 + B_2 + B_3 + B_4 + B_5 + B_6 + B_7 + B_8)$$

$$G = 6\ (1 + 1 + 1.5 + 1.5 + 1 + 9.0 + 1 + 2)$$

$$G = 6\ (18)$$

$$G = 108$$

Step 4 Compare the "G" factor computed with the "G" factor table. The G factor value is less than 200 therefore no de-coupling is required and each ground lines must be laid out such that there "L" factors are equal to or less than 200 - G.

Step 5 Select the appropriate "A" factor for each module position.

		361493 B=1 A=60
		361493 B=1 A=50
361493 B=1 A=40	361493 B=1 A=30	361492 B=1.5 A=40
361494 II B=1 A=25 II B=1 A=25	361494 II B =4.5 A=15 II B =4.5 A=15	361492 B=1.5 A=25

Step 6 Compute "L" factor for Branch #1.

$$L=\frac{(J-1)}{J}\sum_{E_J} A_I B_I$$

$$L=\frac{(J-1)}{J}(A_1B_1 + A_2B_2 + A_3B_3)$$

$$L=\frac{(3-1)}{3}(40x1 + 25x1 + 25x1)$$

$$L= 2/3\ (90)$$

$$L= 60$$

Since 200 - 108 =92, L for branch #1 is acceptable

Step 7 Repeat step 6 for each branch. If the L factor for a single branch exceeds the (200 - G) requirement, an additional branch is necessary.

30 nsec

7.5	7.5	7.5
7.0	7.0	7.0
6.5	6.5	6.5
6.0	6.0	6.0

A-factor

Circuit value of modules is B-factor

Card value is C-factor

$C = \Sigma N A_n B_n$

Table

$C < 100$	No dec.		Note AG
$101 < C < 200$	+3V dec.	0.68 uF.	Note AG
$201 < C < 300$	+3V dec	0.68 uF	Note AG
	+6V dec	0.68 uF	
$300 < C$	+3V dec	6.8 uF	Note AH
	+6V dec.	0.68 uF	

NOTE AG needs Eng. Spec. 811800

DESCRIPTION

The placement or mounting of SLT cards, components, card guides, guide posts, and the affect that these have when all hardware is in place results in various clearances.

PACKAGE

All SLT card sizes 1-2 Hi 6-12 and 3-Hi 12 are affected.

REQUIREMENTS

Card guides are required on all card assemblies. These are snapped on, located, and retained by the card notches just above the housing. Card guides are not called for on the card assembly B/M.

Components must not be mounted on the back of card assemblies.

The maximum height that components may project above the surface of the card is .370 inch. If components do not fall within the .370 inch limit, they may project to a maximum of .460 inch above the surface of the card. Note Code FH is then required on the assembly drawing only in the note code field and is not required on the component. All other limits must be met when this occurs.

The left edge of all cards having note codes FH, FV, or FR will have a black mark. Ref. Eng. Spec. 890913 as it shall have precedence.

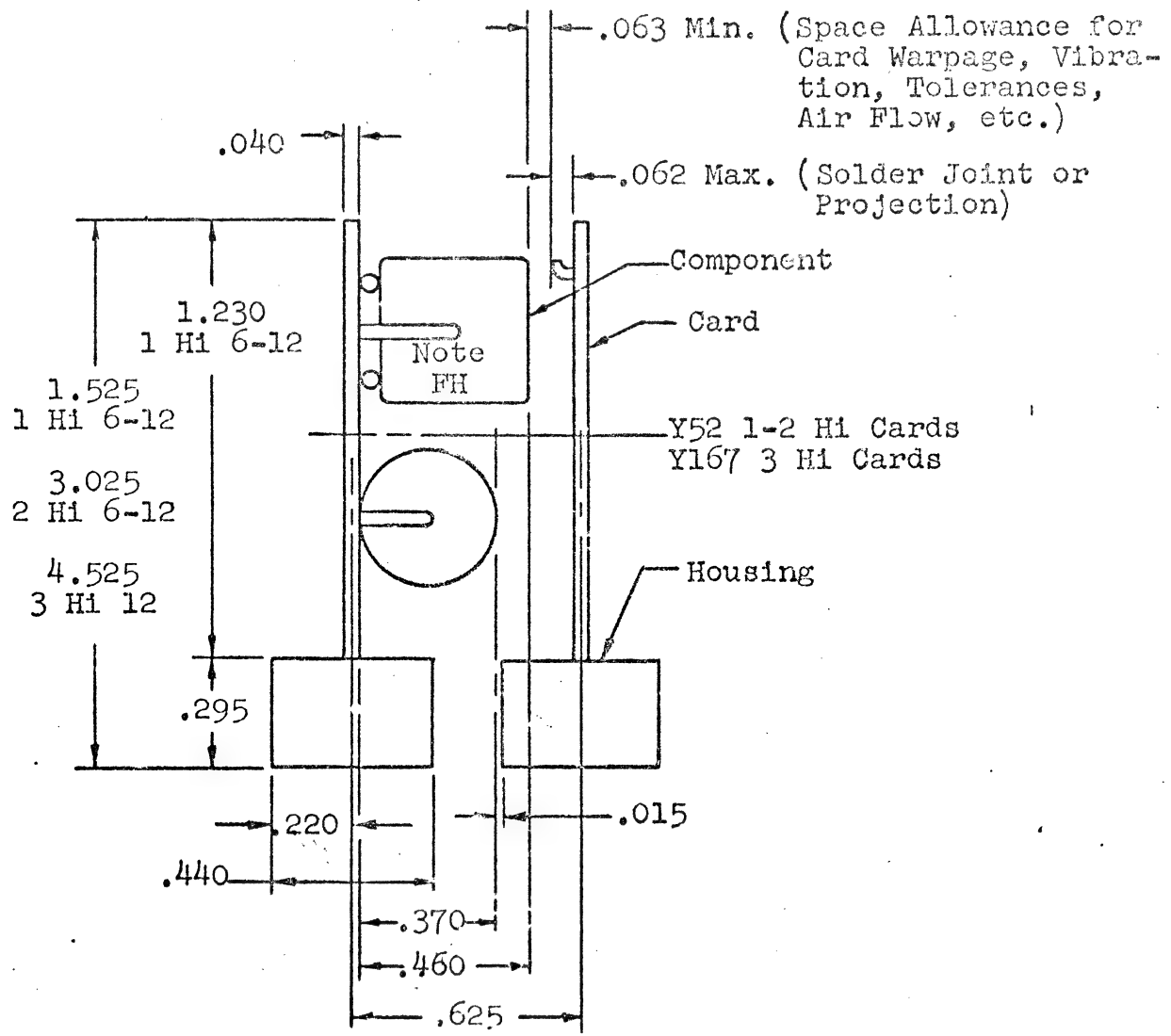
If any component on a card is over .460 inch high, the adjacent card to it must be left out. Note Code FB is then required on the assembly drawing only in the note code field and is not required on the component. All other limits must be met when this occurs.

Note Code FR on current drawings is acceptable but when card assemblies are released or changed this note must be replaced by FH, therefore, FR is obsolescent.

Note Code FV must be used on those TO-5 transistors that are between .370 and .460 when mounted with a spacer. The FV note must appear in the note code field and on the component on the assembly drawing.

LIMITS

The following illustration, chart, and notes A & B, set the limits that all standard card sizes must meet.

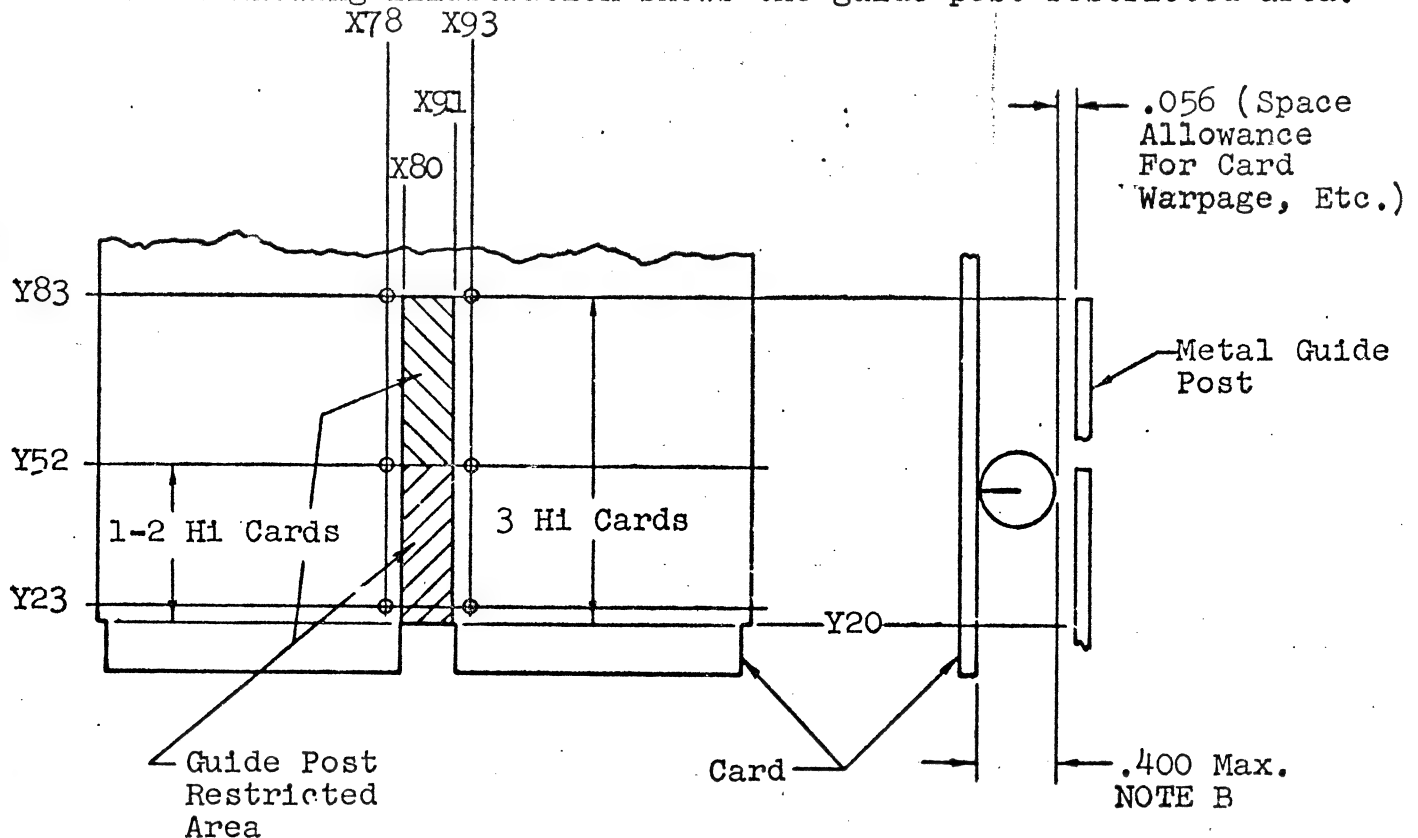
.063 Min. (Space Allowance for Card Warpage, Vibration, Tolerances, Air Flow, etc.)
.040
.062 Max. (Solder Joint or Projection)
Component
Card
1.230 1 Hi 6-12
Note FH
1.525 1 Hi 6-12
Y52 1-2 Hi Cards
Y167 3 Hi Cards
3.025 2 Hi 6-12
4.525 3 Hi 12
Housing
.295
.220
.015
.440
.370
.460
.625

CARD CLEARANCE RESTRICTING COMPONENT HEIGHT

Card Size	Card Guide P/N	Component Height .371 to .460	NOTE CODE	Guide Post Restricted Area (NOTE B)
1 and 2 Hi 6	811802	Above Y52	FH	none
1 and 2 Hi 12	811804	Above Y52	FH	X80 - 91, Y23 - 52
3 Hi 12	813761	Above Y167	FH NOTE A	X80 - 91, Y23 - 83

LIMITS (CONTINUED)

NOTE (A) Components .371 to .410 maximum height may be located above grid Y83 on 3Hi 12 cards. Note Code FH is required.

NOTE (B) Component height may exceed .460 except in the guide post restricted area which is .400 maximum height. Note Code "FB" will be specified in all cases.

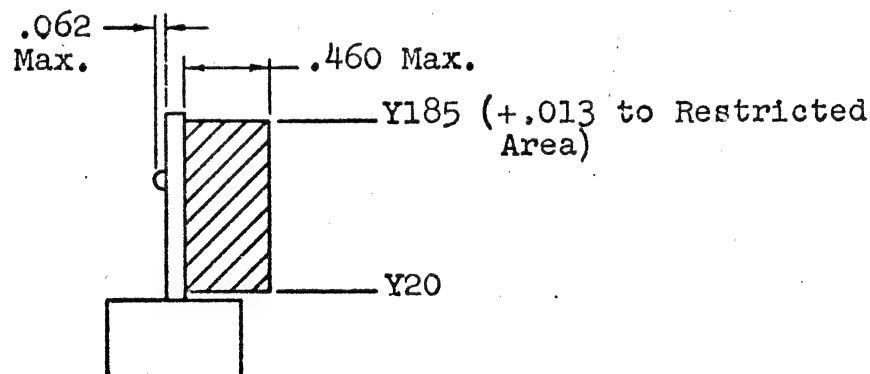
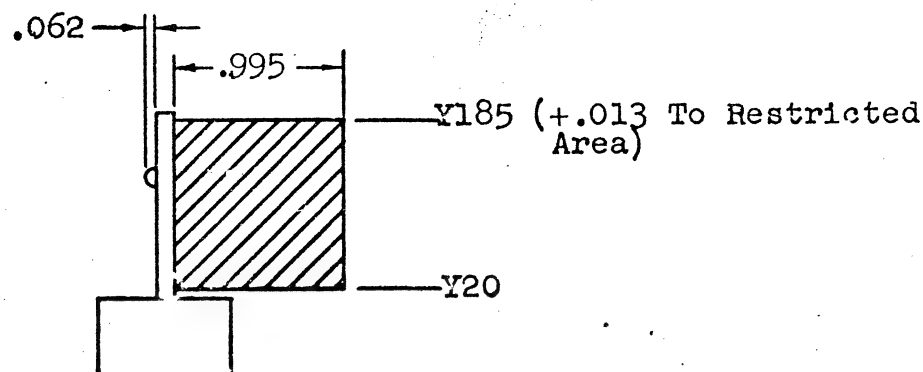
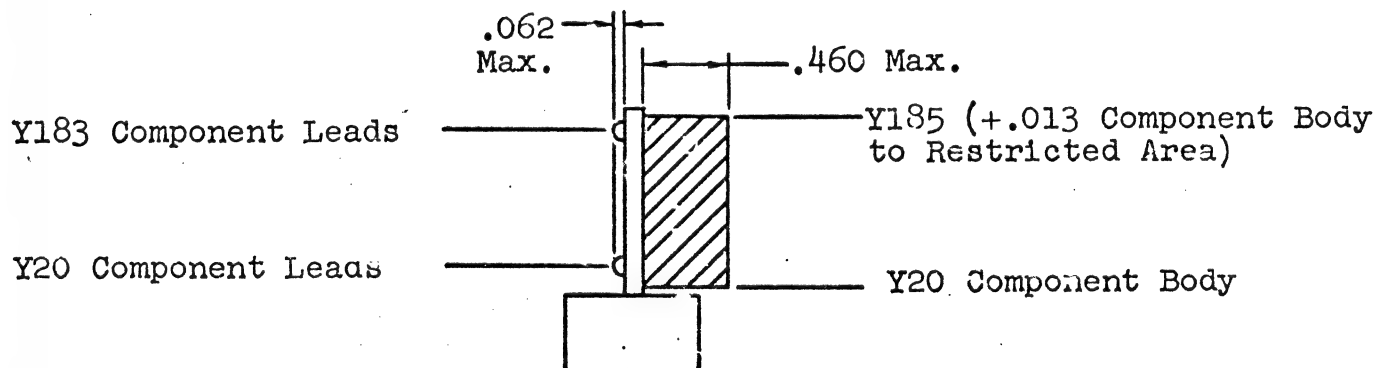
The following illustration shows the guide post restricted area.

A component over .370 inch in height can be mounted in this restricted area only if note code FB is used, which means the next card is left out and the maximum height of .400 is not exceeded.

Component height as it affects card processing within manufacturing. These are not requirements but preferences that should be considered and do not require justification at this time.

LIMITS (CONTINUED)

The views below show the maximum component heights allowed in manufacturing equipment.

"CAFTS" (CARD ASSEMBLY FINAL TESTING SYSTEM)

.062 Max.
.460 Max.
Y185 (+.013 to Restricted Area)
Y20

CLASS IV FINAL CARD TESTER

.062
.995
Y185 (+.013 To Restricted Area)
Y20

AUTOMATIC SOLDER AND CLEANING MACHINE

.062 Max.
.460 Max.
Y183 Component Leads
Y185 (+.013 Component Body to Restricted Area)
Y20 Component Leads
Y20 Component Body

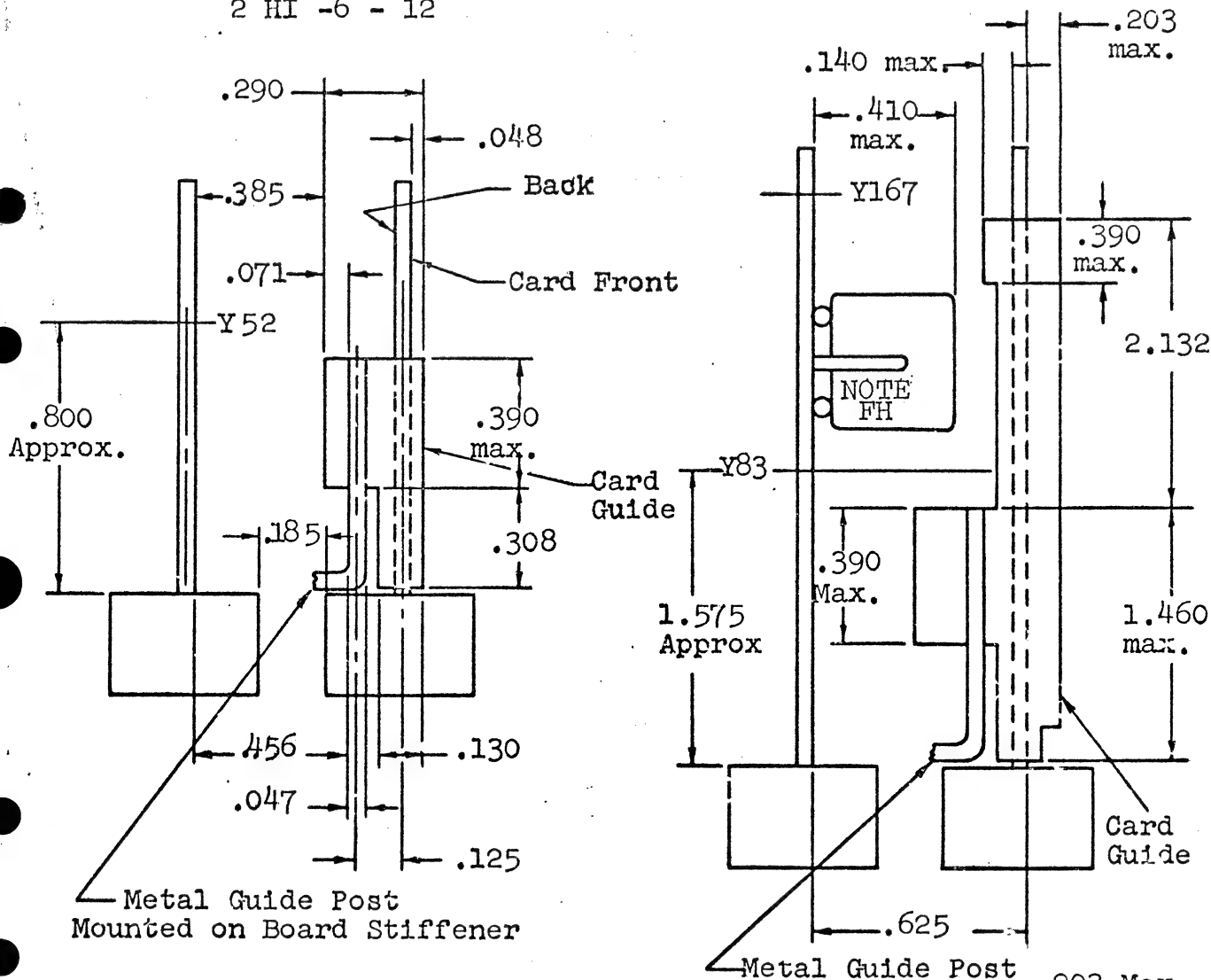
RELATIONSHIPS:

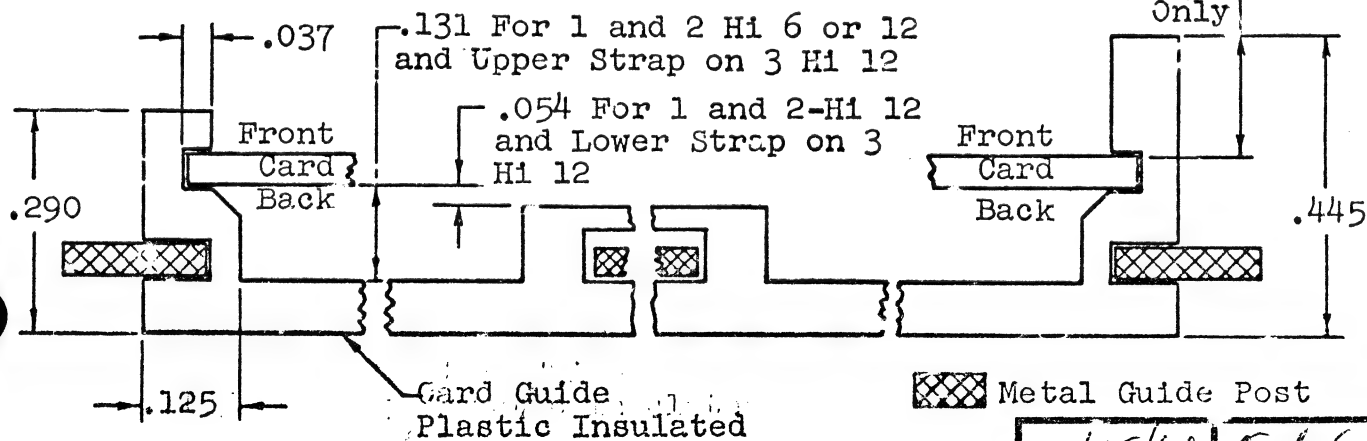
The following illustrations show the physical placement of cards to cards with components, and card guides.

1 HI -6 - 12
2 HI -6 - 12

.290
.048
.385
Back
.071
Card Front
Y52
.800 Approx.
.390 max.
Card Guide
.185
.308
.456
.130
.047
.125
Metal Guide Post Mounted on Board Stiffener

3 HI 12

.203 max.
.140 max.
.410 max.
Y167
.390 max.
2.132
NOTE FH
Y83
.390 Max.
1.575 Approx
1.460 max.
Card Guide
.625
Metal Guide Post

SECTION VIEW OF 1-2HI AND 3HI CARD GUIDES

.037
.131 For 1 and 2 Hi 6 or 12 and Upper Strap on 3 Hi 12
.054 For 1 and 2-Hi 12 and Lower Strap on 3 Hi 12
.203 Max. 3Hi-12 Only
Front Card Back
.290
Front Card Back
.445
.125
Card Guide Plastic Insulated
Metal Guide Post

ARTWORKS

Artwork and components must not be in the restricted area on all card edges. These restricted areas are as follows: Left .047, Top-Bottom .040 and right .025 (Between Y-20 to Y-19).

Lands(.085 "L") and holes (.060 "L") are not allowed on the following X grids because of component lead intereference with card guides.

1-2 Hi 6-12   X22, 79, 149 between Y33 - 52

3-Hi 12   X22, 149 between Y64 - 83 and
X22, 149 between Y148 - 167

SEQUENCE EFFECTS

Cards with components extending into the .370 to .460 inch range must be removed prior to removal of a card adjacent to the extended components. This is necessary because the components extend over the housing of the adjacent card. All other limits must be met when this occurs and note code FH is required.

Cards with components extending above .460 to .995 maximum above Y52 on 1-2 Hi cards and above Y83 on 3 Hi cards will require the card adjacent to be left out of the chassis. All other limits must be met when this occurs and note code FB is required.

HAND ASSEMBLY

Card guides are assembled at the machine build level. Assembly of cards into the machine chassis, intermixing of 1-2 Hi 12 cards on 3-Hi guide post, or 3 Hi cards on 1-2 Hi guide post is not allowed.

PROCESS INFORMATION

The black mark when required is put on the left card edge during final card testing.

Card assemblies using the FB Note Code will have those components that are above .460 subjected to the following:

1. Hand soldered, above .460 height.
2. Card testing, above .460 height are not tested on "CAFTS".

PLANNING

No significant changes are being planned.

SCOPE - This section includes the Program Devices as indicated below and defined in the following sub-sections.

SECTION	SECTION TITLE
8A	Pluggable Program Receptacle
8B	Program Pins
8C*	Pin Programming Information for Machine Group Usage
8D*	Special Program Pins

*These Sections to be added later.

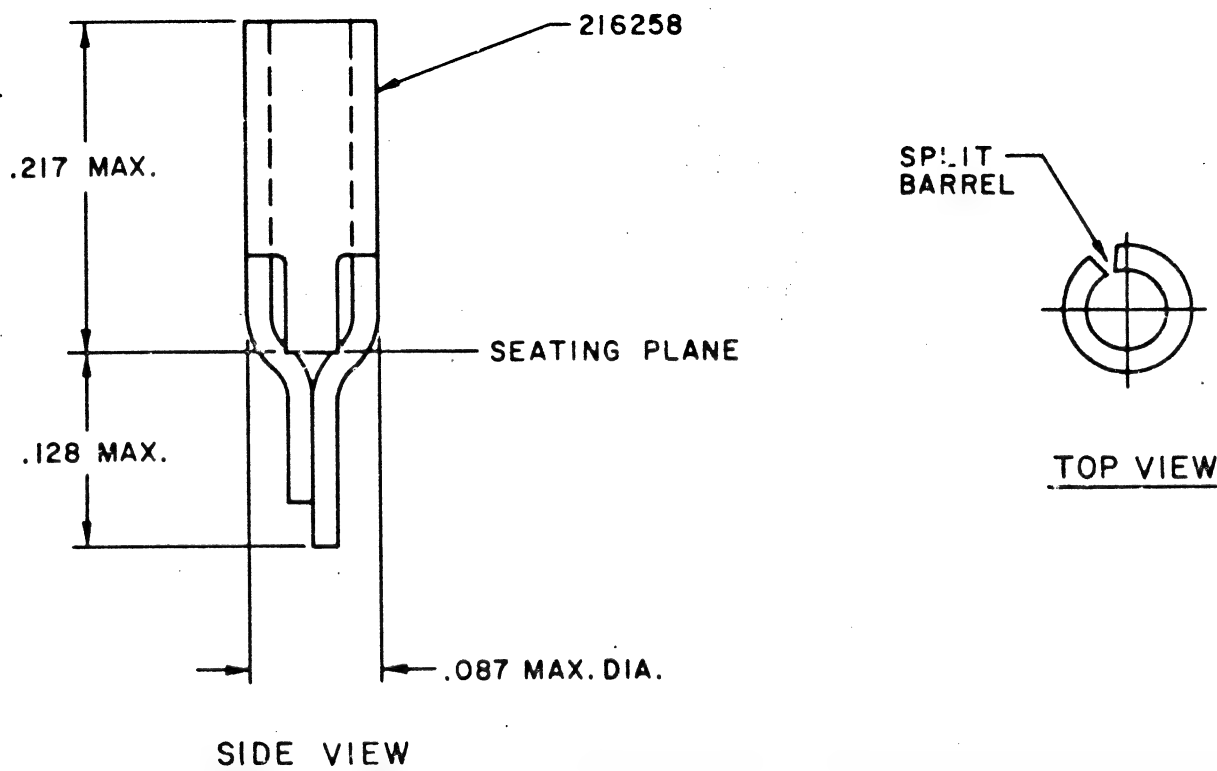
DESCRIPTION

The pluggable program receptacle (216258) is used to facilitate the selective programming of delay lines, circuit load or no load conditions, field replacement card assemblies, signal circuit selection and special feature requirements. Also, it is used as a heat sink for high wattage resistors (Ref. 816006) and for customer machine programming.

It is uninsulated with a split barrel and is mounted vertical to the card surface with projecting tongues on the solder side that can be used to provide mechanical support.

The assembly drawing code is "U".

PACKAGE

There is no physical outline for this component. The receptacle is purchased in strip form or on reels and is held on .150 centers by a tie strip which is broken off in assembly.

SIDE VIEW

TOP VIEW

PACKAGE (CONTINUED)

Views shown are for layout purposes only and the part drawing shall have precedence.

REQUIREMENTS

This component must be mounted in "L" holes on a .125" hole pattern.

Note code HG references the use of program strip contact 811824. This note code will appear on the component view and in the note code field on the assembly drawing. The assembly drawing and bill of material will not reflect P/N 811824.

The following requirements and illustration applies to the insertion of the program strip contact 811824 into contact receptacle 216258:

1 - The program strip contact must be inserted flush to within .016 above the top of 216258.

2 - The program strip contact is not re-usable as it only has one-time pluggability.

3 - The maximum assembly height without folding the rail over is .370.

4 - 811824 will not be on cards in stock or shipped from the card manufacturing plants. Programming will occur at the machine box plants and in the field.

REQUIREMENTS (CONTINUED)

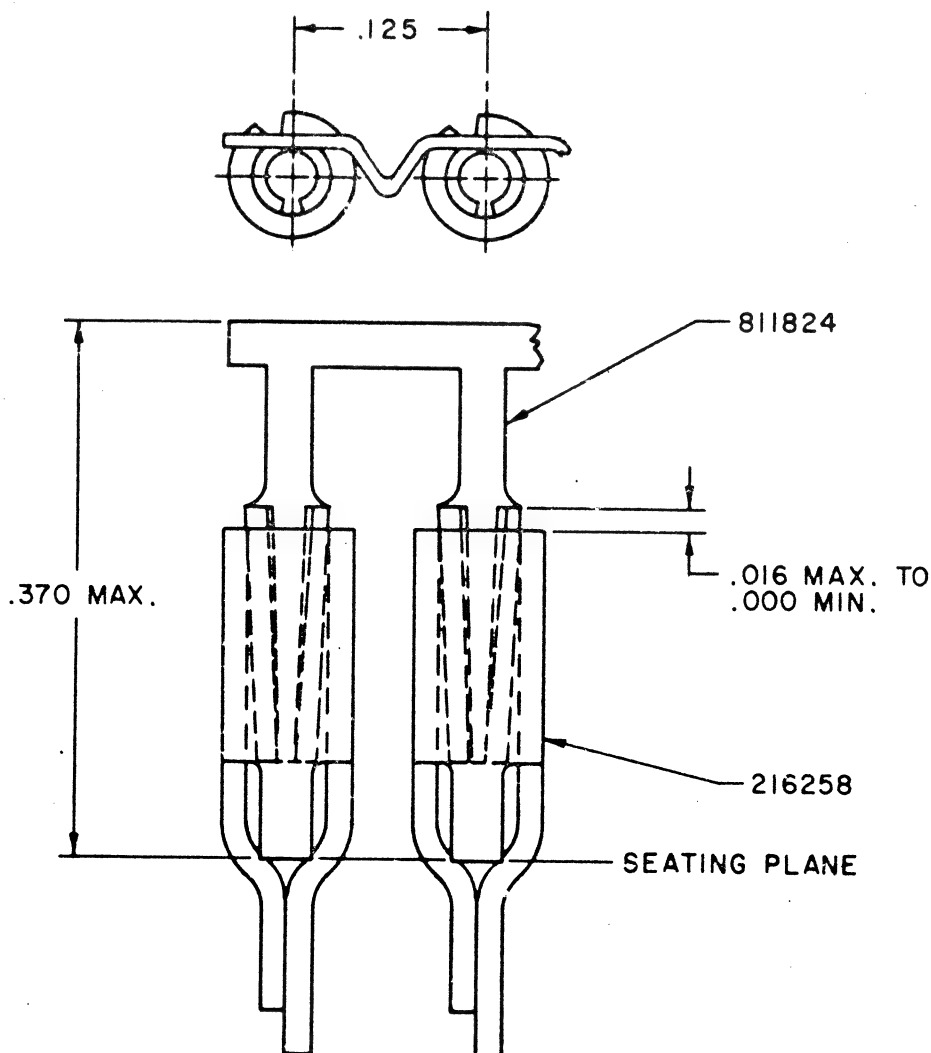
.125

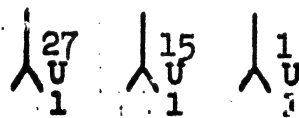
811824

.370 MAX.

.016 MAX. TO
.000 MIN.

216258

SEATING PLANE

Schematic representation will describe contact receptacles and note their specific component code and location number as shown below.

27 U 1   15 U 1   1 U 1

Circuit Flyer representation is specified by flyer S61AY (Part Number 872051).

LIMITS

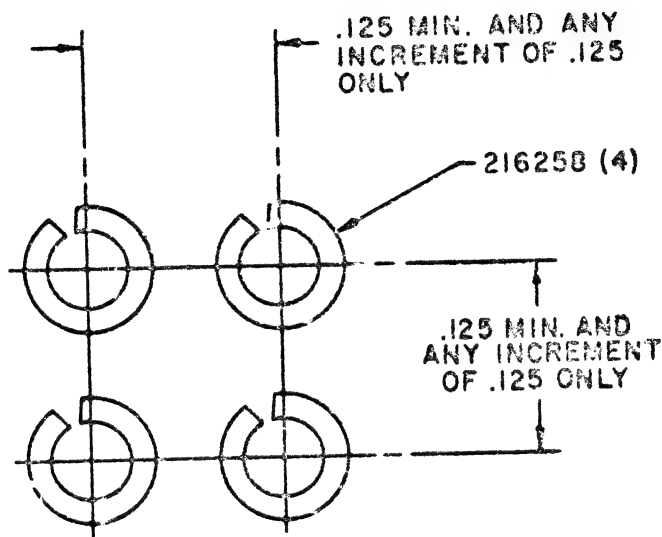
On a standard .125" hole pattern, the contact must be on or within the following X-Y grids:

1 -	Hi 6-12 X23 - 78 - 148	Y28 - 63
2 -	Hi 6-12 X23 - 78 - 148	Y28 - 63 - 123
3 -	Hi 12 X23 - 148	Y28 - 183

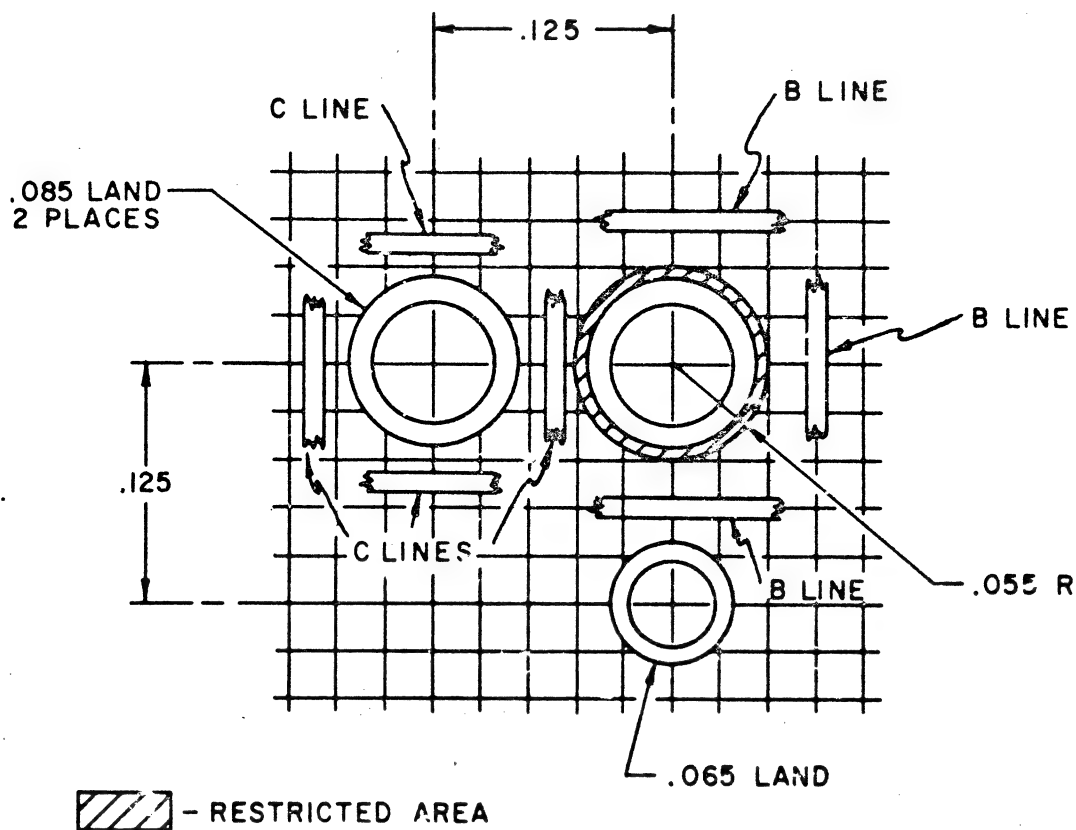
On a random hole pattern, the contact must be on or with the following X-Y grids. Observe "L" hole placement on X22, 79 and 149.

1 -	Hi 6-12 X22 - 79 - 149	Y24 - 63
2 -	Hi 6-12 X22 - 79 - 149	Y24 - 63 - 123
3 -	Hi 12 X22 - 149	Y24 - 183

RELATIONSHIPS

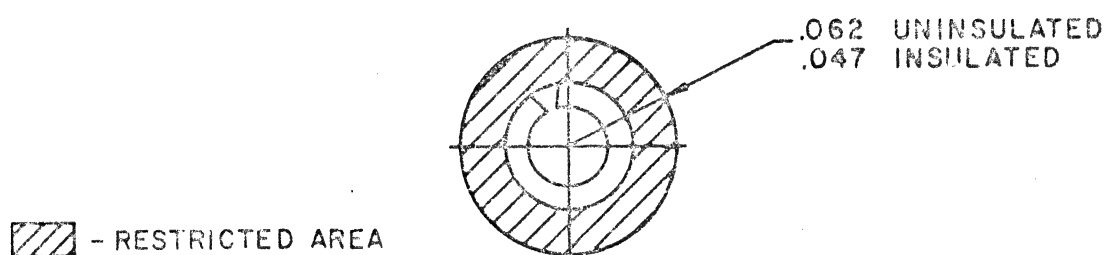
The following illustration shows the minimum placement of adjacent contacts:

TOP VIEW

ARTWORKS

No printed lines will be connected to the land on the component side of the card. All circuit connections to 216258 will be made on the solder sides of the card. The plated through hole will not be used as a via hole or be connected to an internal plane.

SEQUENCE EFFECT

Any component insulated or non-insulated may be mounted next to the contact as long as it does not extend into the restricted area as shown below.

.062 UNINSULATED
.047 INSULATED

- RESTRICTED AREA

TOP VIEW

HAND ASSEMBLY

This package will be hand-assembled on both standard and random hole patterns.

PROCESS INFORMATION

216258 is difficult and costly to assemble. It requires removal from the tie strip and is placed in a fixture which fills the barrel to prevent solder filling. After soldering, the barrels are realigned.

Originally the tongues were spread to provide mechanical support. Manufacturing Process Engineering has evaluated the barrel with tongues not spread. This has been approved and cards are being built this way.

PLANNING

This method of programming (use of the Pluggable Program Receptacle) should be avoided whenever possible. The programming concept as described in Section 8B should be used, as the assembly cost difference is about 83% more for the barrel.

EFFECTIVE DATE: November 28, 1968

SUBJECT: Card layout ground rule status Suffix 3, Section 8B.

This update supersedes DEP 2-7047, Suffix 3, Section 8B dated 4/28/67 and Book 3-10, DEP 2-6420-530 Section 2, Page 6 under "Program Pin 815371".

This section has been updated to include the program pin requirements for SLD and MST.

DESCRIPTION

Usage of program pins defined to include SLD and MST.

REQUIREMENTS

CMT size code added. Plated hole size defined for MST. Eng. Spec. 871185 input to EDT and GPI systems defined.

LIMITS

Expanded to include the five (5) MST card sizes.

HAND. ASSEMBLY

Updated to include MST.

PLANNING

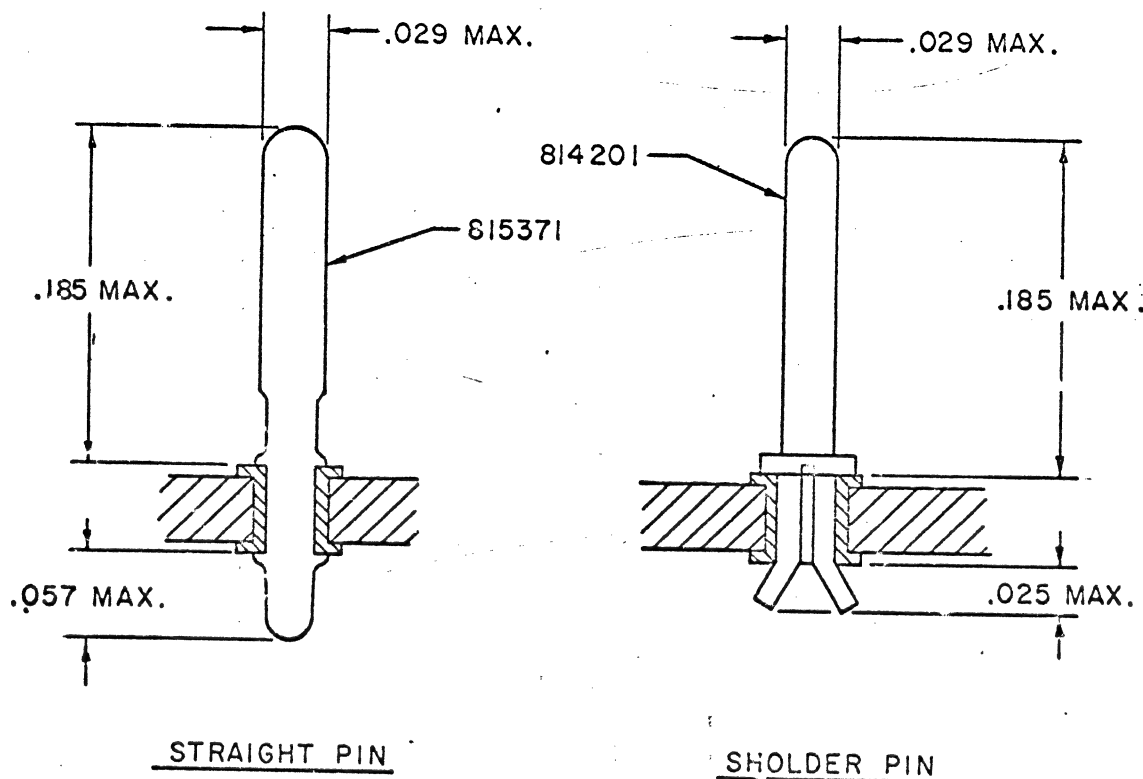
The proposed methods of assembling straight pin 815371 with magnetic fixtures or double-sided tape were not approved by Development or Reliability Engineering. After visual inspection of the solder fillet obtained from these methods, it was found to be unacceptable.

DESCRIPTION

The program pins 815371 (straight pin) or 814201 (shoulder pin)are uninsulated components mounted vertical to the card surface. Pin 815371 is to be used only on a standard hole pattern (3 and 8 grids or equivalent)because the pin is swaged* to the card and the swaging equipment can handle only standard hole patterns. Pin 814201 is to be used only on random hole patterns and MST 1 & 2 as defined under Requirements. The assembly drawing code for program pins is "U".

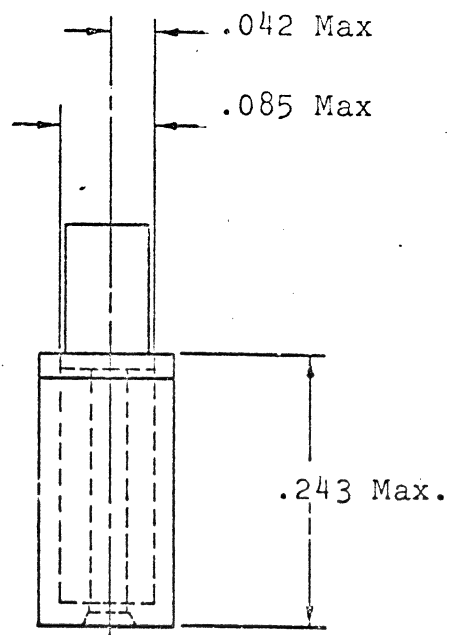
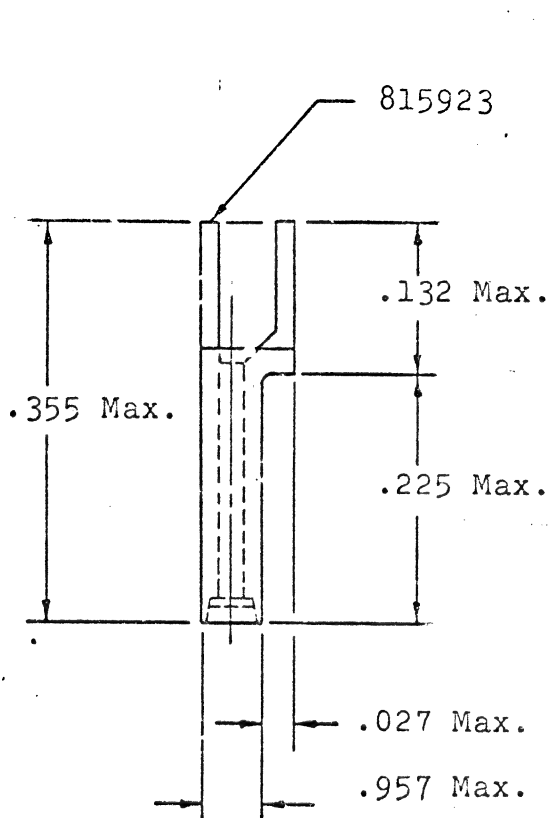
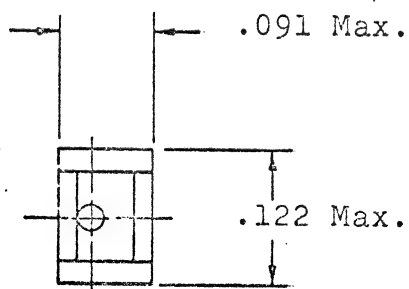
* Pin is swaged - Swaging mechanically secures the pin to the plated hole.

PACKAGE

There are no physical outlines for these components.

Views shown here are for layout purposes only and the part drawing shall have precedence.

PACKAGE (CONTINUED)

The following hardware items are used in conjunction with the program pins and will not be referenced or appear on the card assembly drawings or bills of material:

1 - Connector Housing - 815923
2 - Discrete Connector - 815924 (Tuning Fork)

.091 Max.
.122 Max.
815923
.132 Max.
.355 Max.
.225 Max.
.027 Max.
.957 Max.
.042 Max
.085 Max
.243 Max.

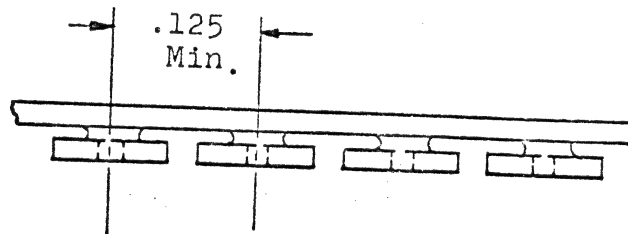
Connector Housing 815923

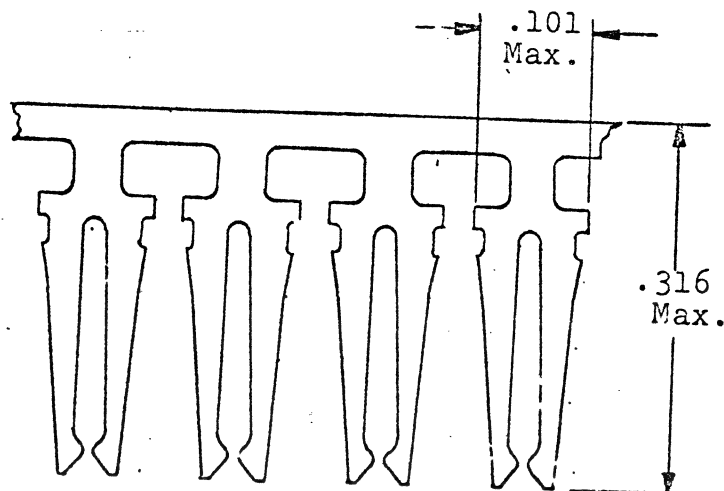
PACKAGE (CONTINUED)

The following illustration shows the Discrete Connector (815924) which is bought as a bulk item in strip form or on a reel on .125 centers.

.125 Min.

.101 Max.

.316 Max.

Discrete Connector

815924

REQUIREMENTS

No note codes are required for these pins. Program pins must be mounted as follows:

815371 - 1) SLT and SLD - "W" (.031) hole.
2) MST 1 and 2 - .031 plated hole - to be used only when all other component leads on the card assembly are .027 diameter or smaller. Card assembly must have standard .031 hole pattern.
3) MST 4 - .031 plated hole.

814201 - 1) SLT and SLD - "J" (.040) plated hole.
2) MST 1 and 2 - .040 plated hole to be used only when any component lead on the card assembly is greater than .027 diameter.

Straight Pin 815371 will be automatically inserted into the card on .125 mounting centers and must meet Engineering Specification 871185.

REQUIREMENTS (CONTINUED)

Engineering Specification 871185 must be specified in the AB Note Code on the assembly drawing in the EDT system and on the CS production control card in the GPI system as well as the assembly B/M. This specification is required in order to assemble the pin to the card.

Shoulder Pin 814201 must be mounted in a "J" hole. It is hand inserted into the card and the slotted end is to provide mechanical support.

Schematic representation will describe program pins and note their specific component code location number as shown below.

17 U 1   15 U 1   1 U 1

Circuit Flyer representation is specified by flyer S61AY (part number 872051).

CMT size code is 1 x 1 with lead code A01. "A" orientation only.

LIMITS

On a standard .125" hole pattern; pin 815371 and 814201 (MST 1 and 2 only) must be on or within the following X-Y grids:

SLT and SLD 1 Hi 6-12

X 23 - 78 - 148   Y 23 - 63

2 Hi 6-12

X 23 - 78 - 148   Y 23 - 123

3 Hi 12

X 23 - 148   Y 23 - 183

MST 2 Hi X 1,2 & 4 wide

X 01-12-26-54   Y C - W

3 Hi X 2 & 4 wide

X 01-26-54   Y C - 9

On a random hole pattern, pin 814201 must be on or within the following X-Y grids. Observe "J" hole placement on X22, 79 and 149.

1 Hi 6-12

X 22 - 79 - 149 Y 23 - 63

2 Hi 6-12

X 22 - 79 - 149 Y 23 - 123

3 Hi 12

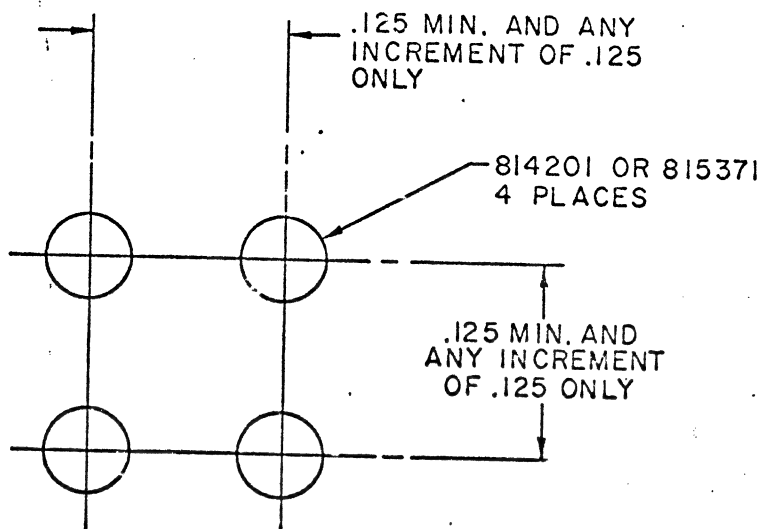
X 22 - 149 Y 23 - 183

RELATIONSHIPS

The following illustrations show the minimum placement of adjacent pins.

.125 MIN. AND ANY INCREMENT OF .125 ONLY

814201 OR 815371
4 PLACES

.125 MIN. AND ANY INCREMENT OF .125 ONLY

TOP VIEW

The following connector housing 815923 shows that it can be placed in various positions as it is off-set and occupies an area .125 square.

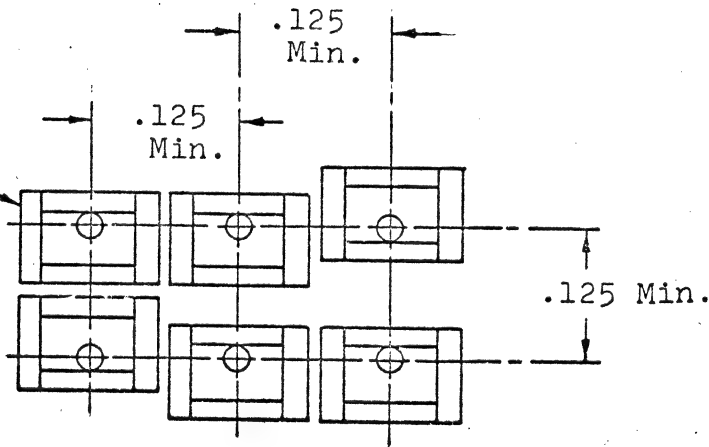
PROGRAM PINS

.125 Min.

.125 Min.

815923

6 Places

.125 Min.

TOP VIEW

ARTWORKS

There are no artwork restrictions on the program pins.

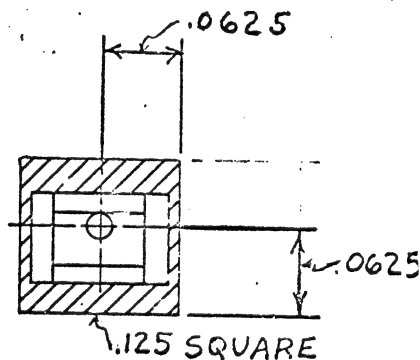
SEQUENCE EFFECT

Program pin (815371) is the first component to be mounted on the card assembly. This is necessary due to the insertion head size that is needed in order to swage the pin.

Any component insulated or non-insulated, may be mounted next to the pin as long as it does not extend into the restricted area as shown below.

.0625

.0625

.125 SQUARE

- Restricted Area

PROGRAM PINS

HAND ASSEMBLY

Pin 814201 is hand assembled and is to be used only on random hole patterns and MST 1 and 2 as defined under requirements. The use of a random hole pattern should be avoided wherever possible due to the additional Manufacturing operations and cost.

PROCESS INFORMATION

At present semi-automatic (pogo stick) insertion equipment is used, which inserts and swages the pin to the card.

PLANNING

Insertion equipment for straight pin 815371 on random hole patterns is not contemplated.

IBM **Division Engineering Practice**

SUPPLEMENT OF STATUS

EFFECTIVE DATE: June 3, 1968

SUBJECT

Card Layout Ground Rule Status
Suffix 3 Section 9 Tubular Axial Leaded Components

This section has been updated to include SLD and MST requirements.

REQUIREMENTS

Machine insertion chart updated to reflect changes in the insertion equipment. The minimum body diameter is changed from .080 to .060 based on minimum diameter change for machine insertion. Circuit master tape (CMT) coding chart has been added to establish the proper CMT size codes for Tubular Axial Leaded Components.

LIMITS

Updated to include the five (5) standard MST card sizes.

RELATIONSHIPS

Updated to reflect the changes to the machine insertion chart.

SEQUENCE EFFECT

Item b.3 - .600 mounting spacing changed to .625 to correct typing error.

HAND ASSEMBLY

Updated to reflect hand assembly of tubular axial leaded components on MST card assemblies.

PLANNING

The paragraph "The Lead Diameters . . . on all the semi-automatic inserters" has been removed due to update to the machine insertion chart. MST 1 - 2 hand assembly of tubular axial leaded components will be eliminated if the planned hole size change is approved. No semi-automatic insertion equipment is contemplated for four (4) wide MST cards.

DESCRIPTION

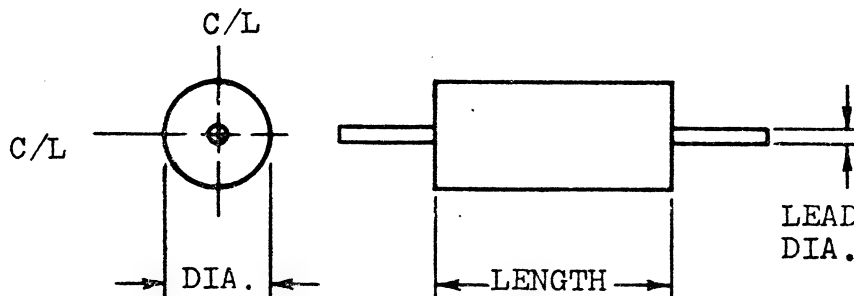
Tubular axial leaded components are in a variety of body lengths, body diameters, and lead diameters. They comprise a large number of types that have various constructions but must always be insulated.

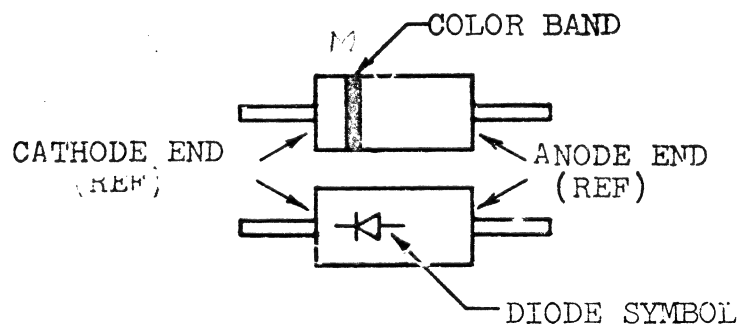
Assembly drawing codes are as follows:

Resistors - R
Capacitors - C
Diodes - CR
Inductor - L
Jumpers - J
Fuse - F

PACKAGE

The following view shows the outline to which tubular axial leaded components must conform. Each of the three dimensions require maximum and minimum in order to define it as machine insertable.

C/L
C/L
DIA.
LENGTH
LEAD DIA.

Polarized capacitors will be indicated by a "+" sign on the end of the component that is positive and is reflected on the part drawing. This will be indicated by a "+" on the positive end on the card assembly drawing.

Diodes are always polarized and the cathode will be indicated in one of the two ways shown below and reflected on the part drawing. This will be indicated by an "X" on the cathode end on the card assembly drawing.

COLOR BAND
CATHODE END (REF)
ANODE END (REF)
DIODE SYMBOL

REQUIREMENTS

Components can be semi-automatically assembled only if they meet the following conditions. Tubular axial leaded diodes must not be mounted on .375 mounting space.

The physical outline codes for diodes that can be machine inserted follow. Any other diode outline code is hand assembled.

.500 or .625 Mounting Spacing
- 1D07A
- 1D07B
- 1D07B1
- 1D07B2

The maximum and minimum columns represent the dimensional limits as specified on the component drawing.

MACHINE INSERTION CHART

	.375 MOUNTING SPACE		.500 MOUNTING SPACE	
	MAX.	MIN.	MAX.	MIN.
BODY LENGTH	.265	.090	.330	.090
BODY DIAMETER	.180	.060	.180	.060
LEAD DIAMETER	.028	.015	.028	.015
PLATED HOLE SIZE	.040 ± .002		.040 ± .002	
HOLE SIZE CODE	J		J	

	.625 MOUNTING SPACE					
	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.
BODY LENGTH	.450	.090	.450	.090	.450	.090
BODY DIAMETER	.250	.060	.250	.060	.250	.060
LEAD DIAMETER	.035	.027	.030	.019	.030	.015
PLATED HOLE SIZE	.060 ± .002		.045 ± .002		.040 ± .002	
HOLE SIZE CODE	L		K		J	

REQUIREMENTS (CONT'D)

Components should be selected according to the following chart for manual insertion, but only if there is no part number to be found that falls under the machine insertion chart. Prep tooling is used for the following mounting spaces. Any other mounting space not shown below will incur additional assembly cost. Tubular axial leaded diodes must not be mounted on .375 mounting space. The max. and min. columns represent the dimensional limits as specified on the component drawing.

HAND ASSEMBLY CHART

			.375 SPACING	.500 SPACING	.625 SPACING	.750 SPACING	.875 SPACING	1.000 SPACING
J Max. Lead Dia. .034	Body Length	MAX	.295	.342	.467	.592	.717	.842
		MIN	.090	.090	.090	.090	.090	.090
(Except .375 spacing Max. Lead Dia. .028)	Body Dia.	MAX	.370	.370	.370	.370	.370	.370
		MIN	.060	.060	.060	.060	.060	.060
K Max. Lead Dia. .039	Body Length	MAX	.212	.337	.462	.587	.712	.837
		MIN	.090	.090	.090	.090	.090	.090
	Body Dia.	MAX	.370	.370	.370	.370	.370	.370
		MIN	.060	.060	.060	.060	.060	.060
L Max. Lead Dia. .051	Body Length	MAX	.200	.325	.450	.575	.700	.825
		MIN	.090	.090	.090	.090	.090	.090
	Body Dia.	MAX	.370	.370	.370	.370	.370	.370
		MIN	.060	.060	.060	.060	.060	.060

Mounting spaces other than those above and starting with .400 are calculated as follows. Maximum body length +.124 + one Maximum lead diameter.

REQUIREMENTS (CONTINUED)

CMT CODING CHART FOR HAND ASSEMBLED
TUBULAR AXIAL LEADED COMPONENTS

	Mounting Space		.375	.500	.625	.750	.875	1.000	1.125	1.250
	Body Length - Maximum		.295	.342	.466	.591	.716	.841	.966	1.091
HOLE SIZE .031 PLATED	Body Diameter-Max	CMT SIZE CODE								
	.060 - .125		4x1	5x1	6x1	7x1	8x1	9x1	10x1	11x1
	.126 - .375*		4x3	5x3	6x3	7x3	8x3	9x3	10x3	11x3
LEAD SIZE .027 MAX.	.376 - .625	LENGTH BY (x) DIAMETER	4x5	5x5	6x5	7x5	8x5	9x5	10x5	11x5
	.626 - .875		4x7	5x7	6x7	7x7	8x7	9x7	10x7	11x7

* Components over .370 maximum diameter require note codes "FH" or "FB".

REQUIREMENTS (CONT'D)

When a component is defined as automatable but for hole diameter reasons cannot be automated, it must reflect the "HR" note code on the asm. drawing. This condition requires justification. For components with butt welded leads, the body length means overall length of the component including butt weld.

Tubular axial leaded components that do not meet the requirements of the manual or automated assembly charts must be mounted on a minimum spacing calculated by adding .124" to the maximum body length plus the maximum diameter of one lead.

LIMITS

The limits specified below are for hand assembled and machine inserted components.

On a standard .125" hole pattern, leads must be on or within the following X and Y grids.

SLT/SLD	1 Hi 6 and 12	X23 - 78 - 148	Y23 - 63
	2 Hi 6 and 12	X23 - 78 - 148	Y23 - 123
	3 Hi 12	X23 - 148	Y23 - 183
MST	2 Hi 1,2 and 4 wide	X01 - 12 - 26 - 54	YC - W
	3 Hi 2 and 4 wide	X01 - 26 - 54	YC - 9

On a random hole pattern, leads must be on or within the following X and Y grids.

SLT/SLD	1 Hi 6 and 12	X22 - 79	Y23 - 63
	2 Hi 6 and 12	X22 - 79 - 149	Y23 - 123
	3 Hi 12	X22 - 149	Y23 - 183

On Y grids 34 through 51, "L" holes cannot be used on X 22, X79 on 1 and 2 Hi 6 and X 22, X 149 on 1 and 2 Hi 12 cards. On 3 Hi 12 cards "L" holes cannot be used on Y 65 thru Y 82 and Y 149 thru Y 166 on X grids 22 and 149. "L" holes cannot be used on Y 23 on all cards.

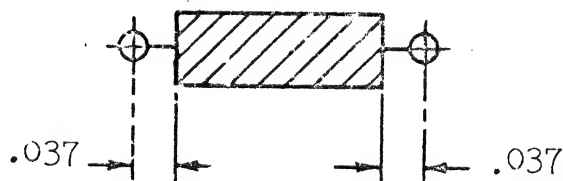
Components must be placed on a vertical axis (parallel to the Y-Y grids) and in such a manner that the component body does not project into the restricted areas.

LIMITS (CONT'D)

The restricted areas designated below include assembly operation tolerances on tubular axial leaded components therefore must not interfere with other components or insertion heads. The component body length may be located anywhere within the restricted area.

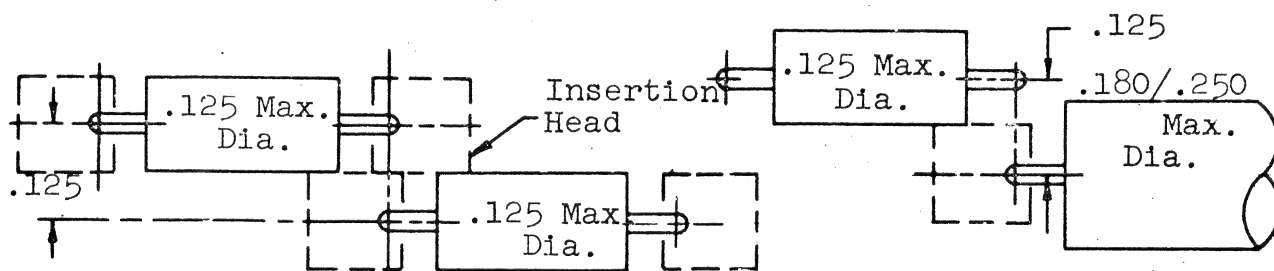
MACHINE INSERTED AND
HAND ASSEMBLY CENTRALITY

.375 MOUNTING SPACE

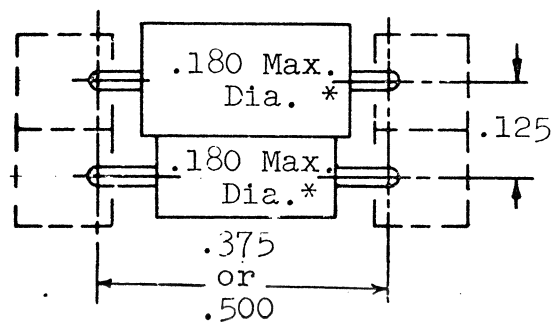
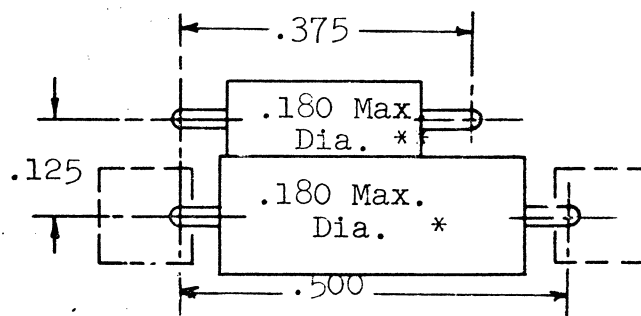
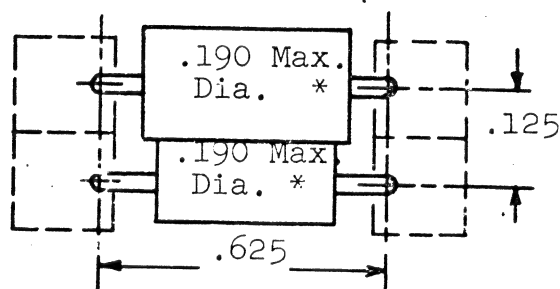
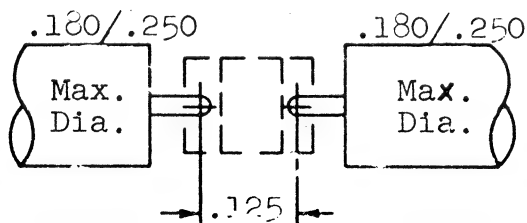
.037 .037

.400 AND UP
MOUNTING SPACE

RELATIONSHIPS

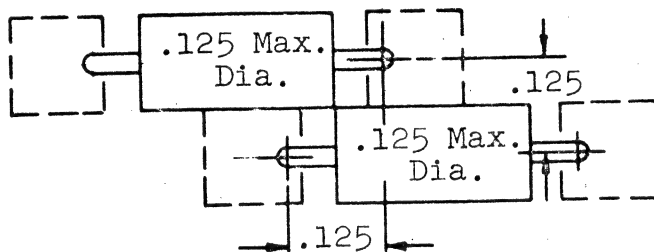
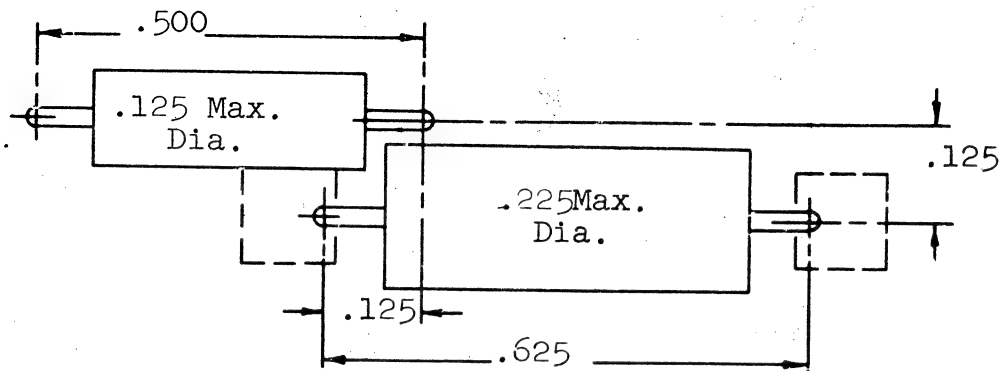
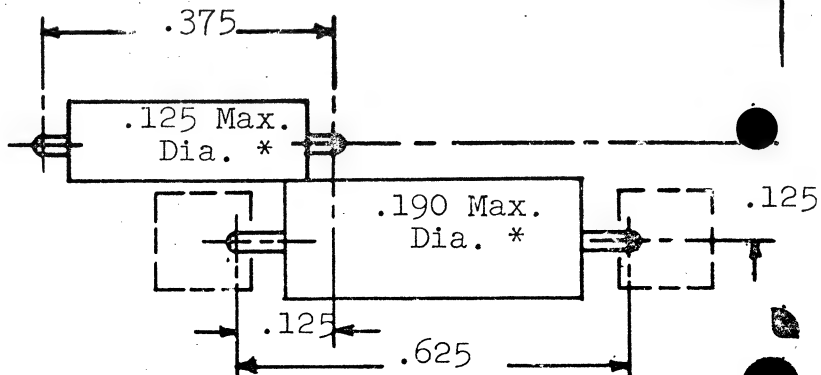
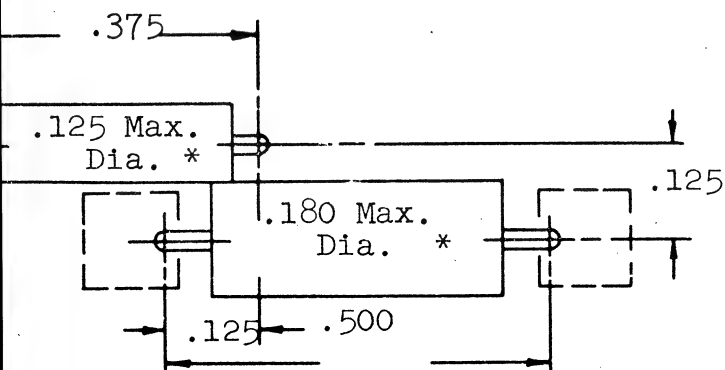
The following views show the relationships of a machine inserted component adjacent to another machine inserted component.

Same "X" axis - Bodies non-adjacent

Both Same Mounting Spacing

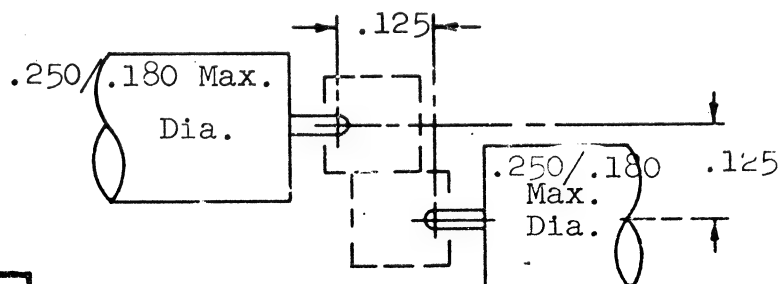
Different Mounting Spacing

Same "X" Axis - Bodies adjacent

Same Mounting Spacing

Different Mounting Spacing

Same "Y" Axis

Same or Different Mounting Spacing

RELATIONSHIPS (CONTINUED)

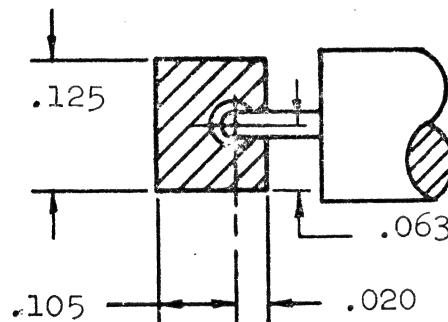
INTERLACING - BODIES ADJACENT

SAME MOUNTING SPACING

DIFFERENT MOUNTING SPACING

STAGGERED PLACEMENT - BODIES NON-ADJACENT

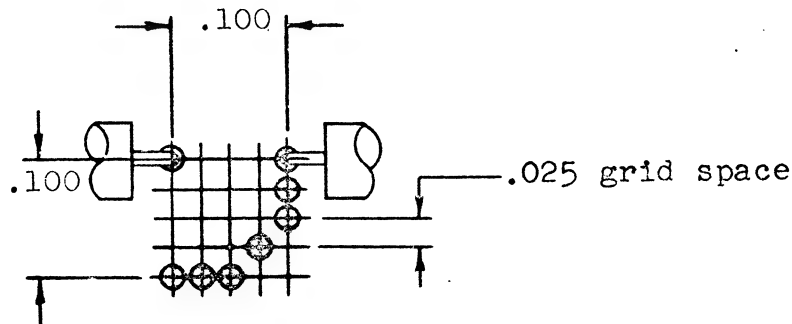
SAME OR DIFFERENT MOUNTING SPACE

* The sum of both diameters must not exceed .250 (Snuggling of components on different mounting spacing is acceptable.)

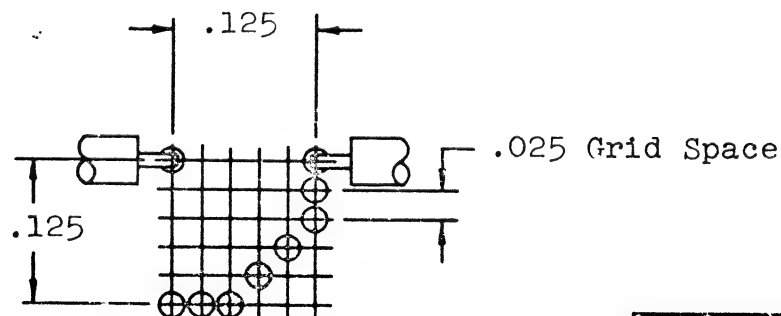
RELATIONSHIPS (CONTINUED)

The following view shows the maximum size of the insertion head.

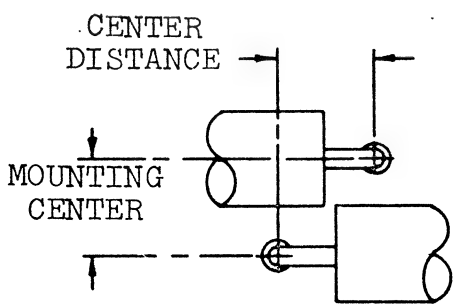
.125
.063
.105 .020

Enlarged View of
Insertion Head Restricted
Area For J, K and L Holes

Defined below is the component minimum placement using J or K holes. One of these may be machine inserted or both hand assembled.

.100
.100
.025 grid space

Any J or K and L combination must observe this minimum placement. These may be machine inserted or hand assembled.

.125
.125
.025 Grid Space

RELATIONSHIPS (CONTINUED)

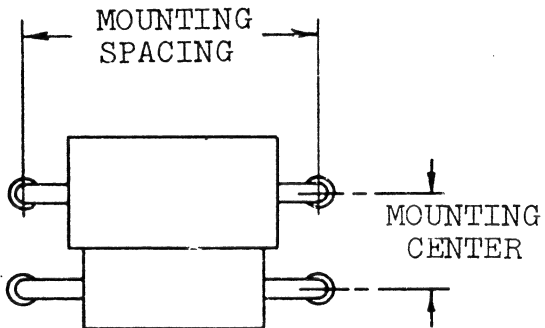
The following view defines maximum center distances, for allowable clearance on bodies of components that are interlaced. This is for mounting centers less than the sum of each body radius. One of these may be machine inserted or both hand assembled, for J, K or L holes.

CENTER DISTANCE

MOUNTING CENTER

Max. Center Distance	Component Mounting Spacing
.075	.375 and .375
.100	.375 and .500 or greater
.125	.500 or greater and .500 or greater

The sum of the body to body radii is equal to or less than the mounting centers. Zero clearance is allowed.

MOUNTING SPACING

MOUNTING CENTER

MACHINE INSERTED AND HAND ASSEMBLED COMPONENTS

RELATIONSHIPS (CONTINUED)

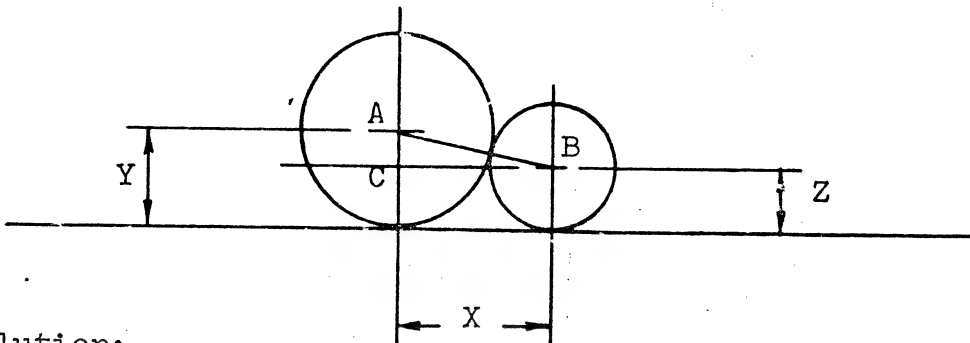
Snuggled components will be assembled on the cards observing all other ground rules.

The sum of maximum radii of two adjacent components shall not exceed their mounting center distance, except when the following formula is applied.

The following is a method for determining the maximum diameter of a component allowed when the diameter of the adjacent component is known, the center to center distance of the holes in the card is known, and the components rest on a common plane.

Given X = Center to center distance
Y = Radius of component whose diameter is known

Find Z = Radius of component whose diameter is unknown

A B C Y Z X

Solution:

1. Z will be maximum when components are tangent to each other.
2. Sides of ABC are:
   AB = Y + Z
   AC = Y - Z
   BC = X
3. From Step 2:

$$(AB)^2 = (BC)^2 + (AC)^2$$

$$(Y + Z)^2 = X^2 + (Y-Z)^2$$

$$Y^2 + 2YZ + Z^2 = X^2 + Y^2 - 2YZ + Z^2$$

$$4YZ = X^2$$

$$Z = \frac{X^2}{4Y}$$

ARTWORK

No artwork restrictions exist, specifically, for tubular axial leaded components. All components must be insulated.

SEQUENCE EFFECT

The following illustration shows the physical relationship between tubular axial leaded components and

a. Program contacts. (Receptacles are manually assembled later but clearance has been provided since they are larger than the contact.)

b. Other tubular axial leaded components

1. .375 Mounting Spacing Tubular Axial Lead
2. .500 Mounting Spacing Tubular Axial Lead
3. .625 Mounting Spacing Tubular Axial Lead

All four components are assembled in this fixed sequence. All components within a given mounting spacing are randomly assembled.

The table applies whenever the long dimension, (layout view), of the receptacle is parallel to the length of the tubular axial lead component.

PROGRAM CONTACT (3 PLACES)

(See Table)

.125 min.

.100 min.

Program Receptacle 2 Places

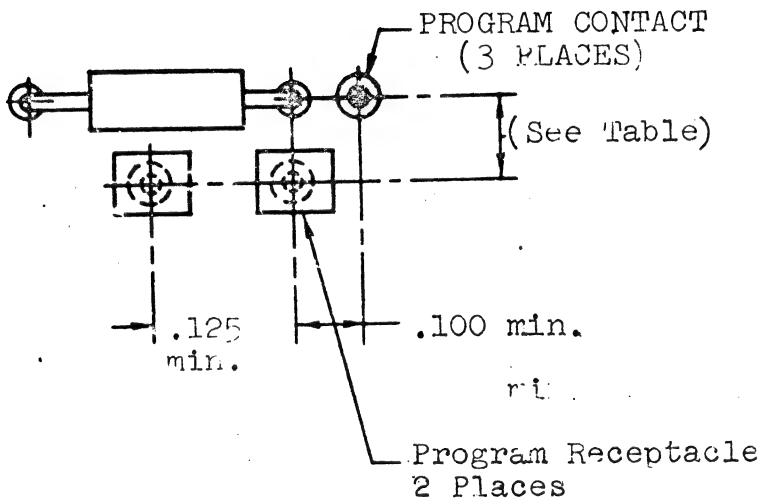



Table	
Hole Spacing	Max. Body Diameter
.100	.120
.125	.170
.150	.220

HAND ASSEMBLY

All Tubular Axial Lead components will be hand assembled if their leads are not on the standard X-Y grids ending with 3 of 8. If the components do not meet the dimensions in the machine insertion chart they are also hand assembled. All Tubular Axial Leaded components on MST card assemblies will be hand assembled using double-sided tape.

PROCESS INFORMATION

Axial Lead Tubular components that meet the machine insertable chart and are mounted on the standard X-Y grid pattern will be semi-automatically assembled to the card. These inserters cut, form and insert lead taped components.

Where possible, similar components shall all be put on a card at the same spacing and orientation. This will minimize setup time during the manufacture of the card assembly.

After tubular axial leaded components are assembled, (either semi-automatic or hand assembled), the leads are flagged and cut.

All hand assembled components will have their leads pre-formed.

.375 mounting is preferred for $\frac{1}{4}$ watt size.

PLANNING

No semi-automatic insertion equipment is being considered for components located off the standard X-Y grids ending in digit 3 or 8 or for four (4) wide MST cards.

Once the hole size change for MST 1 and 2 is approved Tubular Axial Leaded Components can then be machine inserted provided the component dimensions meet the machine insertion chart.

TESTING REQUIREMENTS

This section is concerned with those portions of the circuit card layout and representation that affect both in-process and final assembly testing. Also included will be the limitations and minimum requirements for each piece of test equipment involved.

Testing functions will be explained in the following sequence:

- In-process testing of card panels
- Card assembly testing
- Cable card testing
- Circuit design and packaging considerations

SCOPE

The purpose of this section is to provide a basic understanding of the requirements on card packaging in relationship to the testing function. Considerable product cost savings can be realized when cards are designed to allow testing by semi-automatic or automatic equipment.

The test data used by these testers is developed by either automatic processing of the EDT, or is manually developed at Endicott for input to the Test Generation programs.

DEFINITIONS

In-process testing is a term which refers to a testing operation performed on cards between certain assembly or chemical operations in order to control a manufacturing process. In general, the segment of the manufacturing line under consideration here is between the stock level of the basic sheets and the operation which places contacts and housings on cards.

Standard grid: (X-Y grids ending in 3 and/or 8 for cards) Standard grid (.125) is a term which refers to coordinates on cards which are on an .125 inch grid where the reference coordinates (Ref. dwg#813137, Card Panel Layout).

Twenty-five thousandths-inch grid System (.025) is a term which refers to coordinates on cards which are on a .025 inch grid where the reference coordinates are identical to the above paragraph.

IN-PROCESS TESTING

Requirements and limits for testing internal planes laminates, drilled holes, plated holes, and card in panel forms.

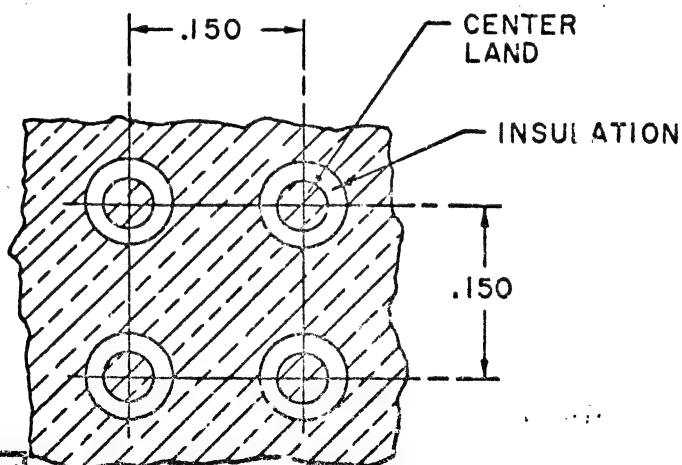
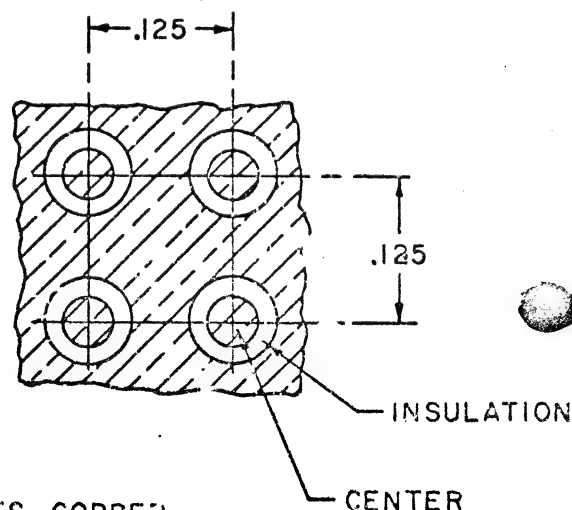
In-Process Testing Equipment

The following machines are used for in-process testing of card panels.

1. Core Plane Tester
2. Drilled Hole Tester
3. Plated Through Hole Tester
4. Shorts and Continuity Card Panel Tester

In-Process Testing Ground Rules By Machine

1. Core Plane Testers
   A.-Singles Tester
   1. Tests standard 10" x 15" panels
   2. Tester will test copper center lands on the standard grid.
   3. Coordinates not on the standard grids cannot be tested on the Core Plane Tester, but must be manually tested.
   4. Handles panel thickness between .005 thru .125 inch.

   B.-4up Tester
   1. Tests standard (4 ups) panels 22" x 31"
   2. Core Plane Tester will test center lands on the standard grid. Testing cannot be performed if center lands are not present.
   3. Testing will not include shorts and continuity testing between various voltage areas assigned to one plane.
   4. Coordinates not on the standard grids cannot be tested on the Core Plane Tester.

2. Drilled Hole Tester
   A. Tests standard 10" x 15" panels.
      1. Tests holes located on standard or .025-inch grid on and within a 9" x 14" rectangle located symmetrically on the 10" x 15" panel.
      2. Tests drilled hole diameters between .029 thru .085 inch.
      3. Panel thickness must be between .035 thru .065 inch.
3. Plated Through Hole Tester
   A. Tests standard 10" x 15" panels.
      1. Test holes located on standard grid or .025-inch grid, on and within a 9" x 14" rectangle located symmetrically on the 10" x 15" panel.
      2. Tests plated hole diameters of .035 thru .043 inch.
      3. Panel thickness must be between .035 thru .065 inch.
4. Shorts and Continuity Card Panel Tester
   A. Tests standard 10" x 15" panels
      1. Tests card types laid out on the standard panel (ref. 813137)
      2. Tests hole diameters between .026 thru .063 inch.
      3. Panel thickness must be between .035 thru .065 inch
      4. Cannot test holes or tabs not on the standard grid. Non-standard grid cards are manually tested.
      5. Cannot test panels which contain pins, hardware or components.

FINAL ASSEMBLY TESTING

The test equipment which will perform the Final Assembly Testing operation (Suffix 10) has been designed to accommodate the majority of standard SLT cards. The equipment does have limitations and minimum requirements in the areas of circuit representation and card packaging. By designing cards that fall within these limitations or meet the minimum requirements, a machine group will ensure a high quality card at an economical cost.

Automatic Test Equipment

General - The information that follows will briefly describe the SLT Card Final Test System (SCFTS) input data generation routine (Automatic Test Generation System). Also cevered in some detail will be the requirements and limitations, both mechanical and electrical, of the SCFTS.

A functional description of the SCFTS along with its role in the overall SLT card final assembly testing operation is covered in Suffix 10, Section 3.

Automatic Test Generation System - This system consists of a series of computer programs which uses as input, Circuit Flyers and Logic Test Data.

ENG. | MFG.

Logic Test Data → 3 EDITOR Routine

Circuit Flyers → 1 Check and Coding → 2 MCF Routine → 3 EDITOR Routine → 4 SALT Programs → 5 TDF Programs → SCFTS

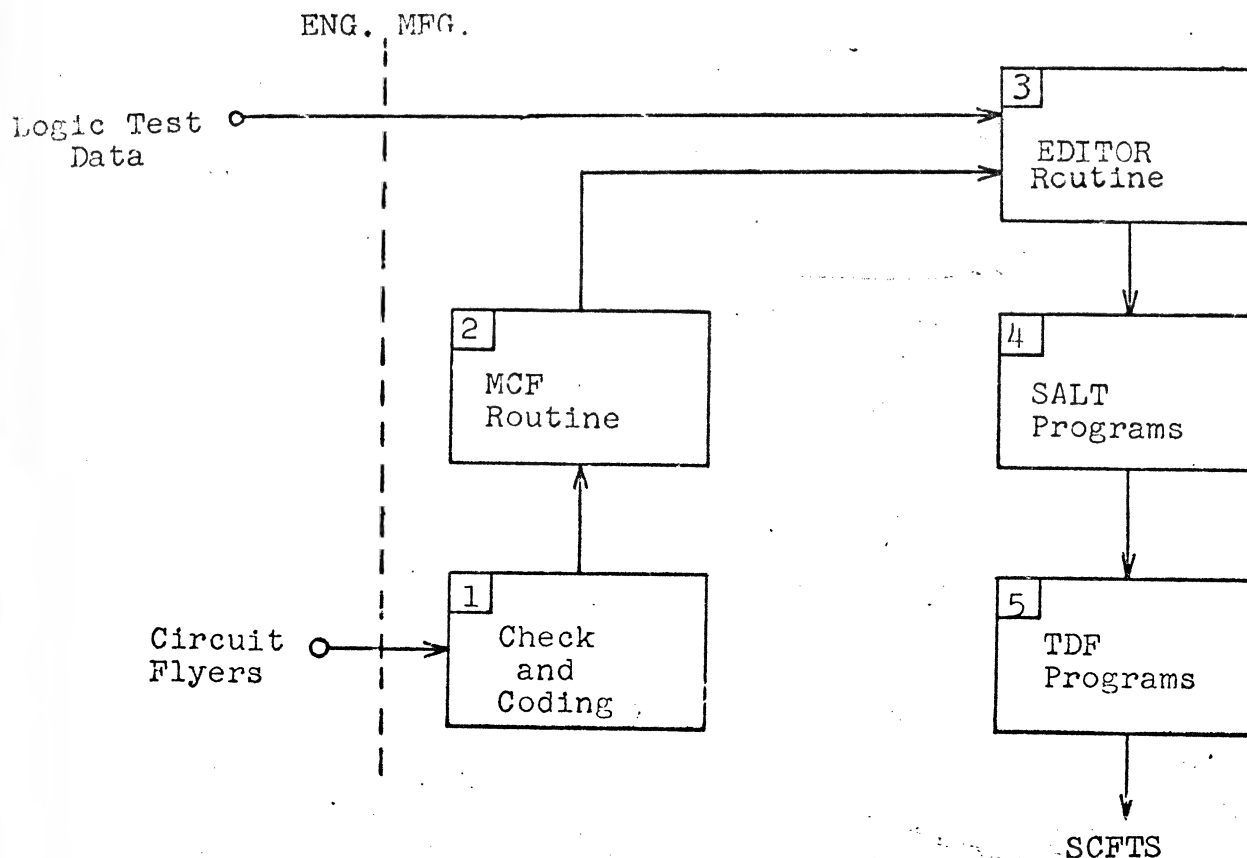



Figure 1

SALT Programs - (Fig. 1 - Block 4)

• The Sequential Automated Logic Test (SALT) programs are of prime importance in the test generation system. These programs generate the necessary shorts-opens, DC impedance, and logic test patterns for the SCFTS. They also define error analysis for failing test patterns by the indication of faulty components location on the card. The SALT program must have the circuitry in question described in terms of circuit blocks, each representing only one of the following basic logic functions: And, Or, Invert, And-Invert, Or-Invert, Resistor, and Capacitor.

TDF Program - (Fig. 1 Block 5)

The Test Data File (TDF) converts test data prepared by the SALT programs into SCFTS readable data and loads this information, identified by part number and EC Level, into the DISC File System which controls SCFTS.

EDITOR Routine - (Fig. 1 Block 3)

This routine is designed to substitute a series of interconnected logic functions in place of a multi-function single circuit block representation shown on the Card ALD or in Logic Test Data. An example of this would be the Polarity Hold circuit flyer T03AK. This circuit appears on the card ALD and in Logic Test Data as a single block, but is acted upon by the EDITOR routine and presented to the SALT programs as a group of 5 interconnected logic functions.

MCF Routine - (Fig. 1 Blocks 1-2)

Each circuit flyer is examined and categorized. Those which represent only one basic logic function or a circuit sutiable for the EDITOR routine are subjected to a worse case design analysis. All others are manipulated to a lesser degree.

The resultant information is placed on a magnetic tape record called the Master Circuit File (MCF). Each record on this file represents a circuit flyer identified by the circuit flyer block identification code and EC level. Within each record, depending upon the type of flyer, will be instructions to the EDITOR routine on SALT programs, DC impedance test information, worse case "0" and "1" state parameters for inputs and outputs, and error analysis information.

Logic Test Data (Fig. 1)

This data is furnished by Engineering. It provides Test Equipment with circuit block card pin interconnection data along with component location data for each card.

Circuit Flyer Requirements & Limitations:

Each circuit flyer must adhere rigidly to the requirements set forth in Suffix 2. For guidance with Test Equipment circuit flyer requirements, contact the local Test Equipment Representative (Suffix 11).

Electrical Requirements & Limitations:

Shorts-Opens Tester

The shorts-opens portion of the SALT programs assumes each card contact spring to be "open" from every other card contact spring unless told otherwise. There are two acceptable methods of indicating a shorted condition between them.

1. Signal card springs - The shorted condition between two or more signal card springs must be indicated on the card ALD by the use of a special jumper circuit flyer (S61AF) as many times as is needed.

2. Source voltage card contact springs - If two or more card springs are referenced to a distinct source voltage in the voltage pin (springs) comment area on the card ALD Suffix 1, the shorted condition of these pins will be assumed.

When this multi-voltage pin situation arises, a note must be present near the bottom of the 1st sheet of the card schematic drawing stating the bussing condition of these pins (Suffix 8).

ex: "Voltage pins D08-J08 are bussed"

"Voltage pins D03-J03 are not bussed"

Impedance Tester

The Impedance Tester portion of SCFTS is capable of making DC resistance and capacitance measurements between two card springs within the following limits:

Resistance - 18 ohms to 1.8 meg ohms

Capacitance - .1 mfd to 20 mfd

Certain portions of analog Class 4 circuitry can be tested at this test station, if sufficient test points to card springs are available.

Logic Tester

The Logic Tester portion of SCFTS is capable of performing logic tests on circuitry which meets the following requirements:

1) The circuitry to be tested must be capable of being described in terms of the seven basic logic functions (see SALT Programs).

   Cards that contain a mixture of logic and analog circuitry will be tested only to the extent of functioning whatever circuitry that conforms to the requirements stated above, and whose digital nature is not adversely affected by connection to analog or non-digital circuits. (See Circuit Design and Packaging Considerations - Test Points Class 4 Circuitry).

2) Source voltages necessary for circuit operation are between +12 and -12 volts. Current requirements for each source voltage are as follows:

   ≥500 ma for voltages between +6 and -6 volts.
   ≥300 ma for voltages between +6 and +12 volts.
   ≥300 ma for voltages between -6 and -12 volts.

   Note: These requirements apply only when card pins normally reserved for source voltages are used.

3) Input signal voltage swings are between a minimum of .8 volt to a maximum of 12 volts within the limits of +12 and -12 volts.

4) Input signal current falls within the following limits: $+1 \text{ ma} \leq \text{Iin} \leq +100 \text{ ma}$, $-1 \text{ ma} \leq \text{Iin} \leq -100 \text{ ma}$.

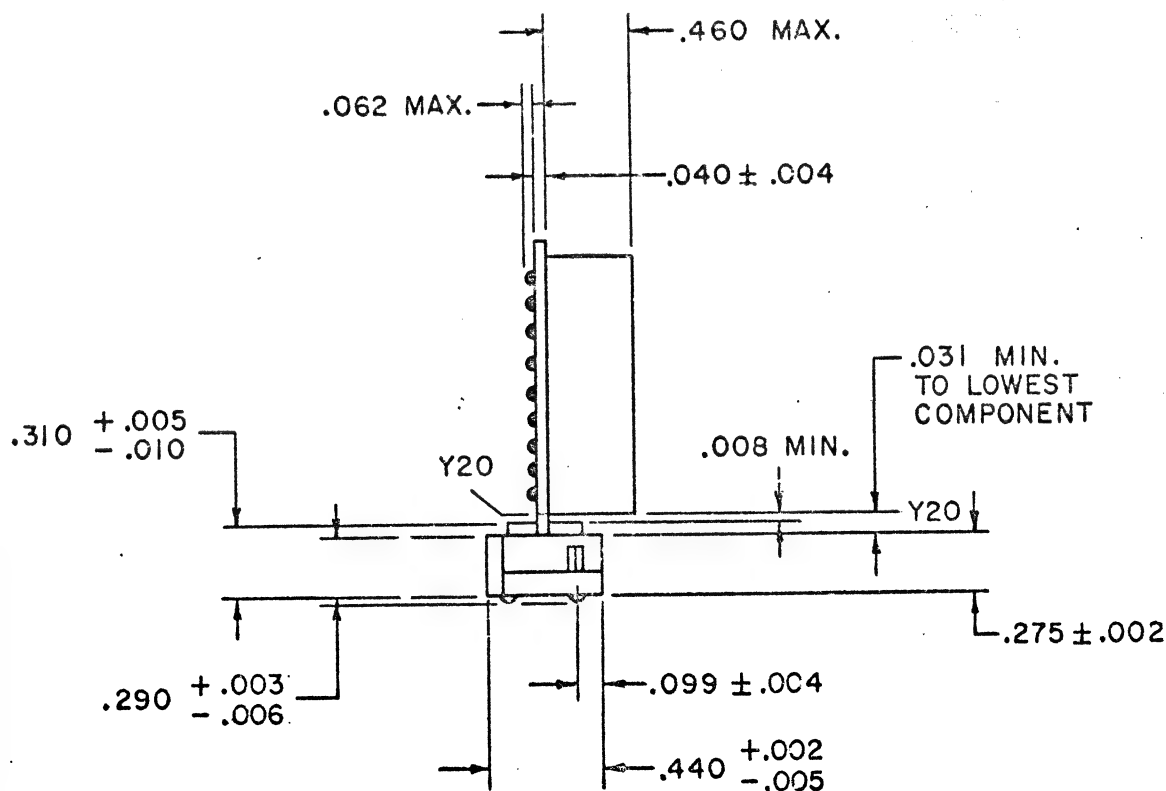
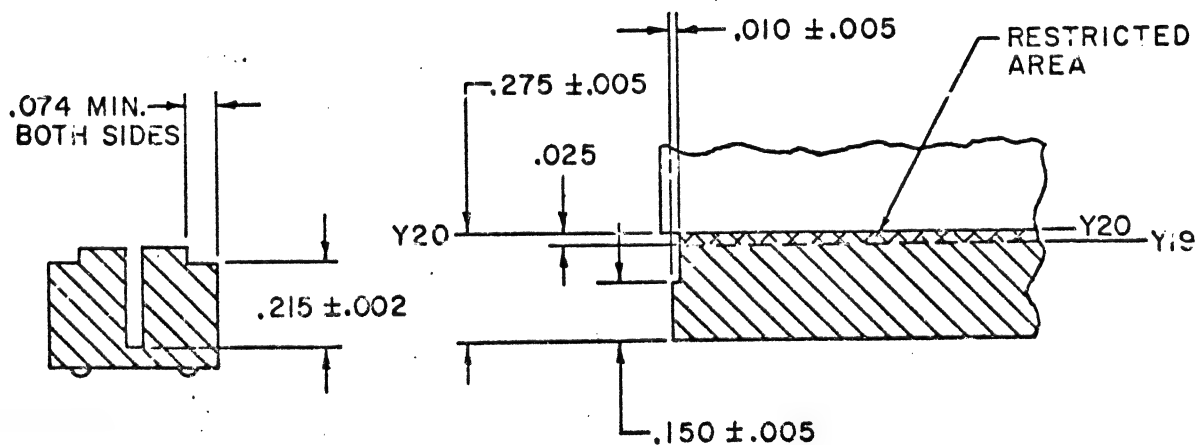
5) Output signal voltage seings are between +12 and - 12 volts.

6) Output signal current - same limits as input signal current.

7) Card springs which are normally reserved for circuit ground (D08 & J08) are not used for other voltages or for signal inputs or outputs.

Mechanical Requirements & Limitations

In order to be acceptable for test on the SCFTS the physical dimensions of the card assembly must conform with the views on the following pages.

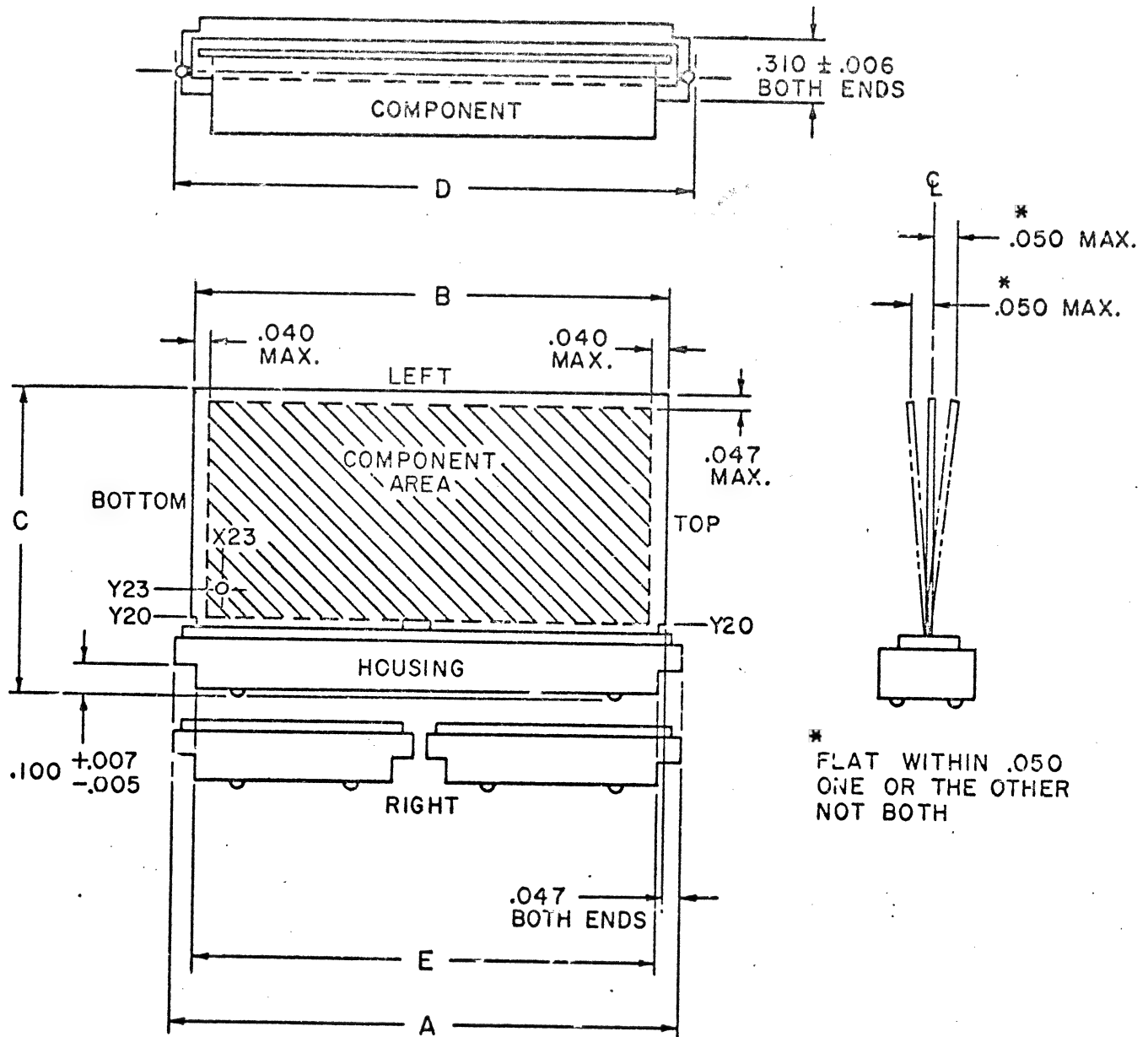
MECHANICAL REQUIREMENTS AND LIMITATIONS (CONT'D)

SLT CARD TYPE LIMITATIONS

MECHANICAL REQUIREMENTS AND LIMITATIONS (CONT'D)

SLT CARD TYPE LIMITATIONS (CONTINUED)

COMPONENT
.310 ±.006 BOTH ENDS
D

B
.040 MAX.
.040 MAX.
LEFT
.047 MAX.
COMPONENT AREA
BOTTOM
TOP
C
X23
Y23
Y20
Y20
HOUSING
.100 +.007 −.005
RIGHT
.047 BOTH ENDS
E
A

℄
* .050 MAX.
* .050 MAX.

* FLAT WITHIN .050 ONE OR THE OTHER NOT BOTH

TYPE	A		B		C		D		E	
1-6	1.720	±.005	1.625	±.003	1.535	+.008 −.011	1.754	±.005	1.609	+.003 −.005
1-12	1.720		1.625		3.035				1.609	
2-12	3.470	±.010	3.375		1.535		3.506	+.005 −.007	3.357	±.006
2-24	3.470		3.375		3.035				3.357	
2-36	3.470		3.375		4.535				3.357	

All card assemblies will be guaranteed to be free of dust, dirt, oil or other particles prior to entering the test area.

Standoffs on the base of the card housing will always be provided as in the present housing design to assure proper seating of the housing when plugged onto the SLT board (or, in our case, test carriers).

Retainer clips or other means of securing the housing to the card will be sufficiently strong to withstand at least 10 pounds maximum of static force applied in such a manner as to separate the housing from the card.

The test area in the SLT card manufacturing process throughout the corporation utilizes a test carrier (Endicott tool # 9950393) based on the board re-formed pin design. All cards are plugged on these carriers for the entire testing process. Therefore, any changes in the spring contact design which would affect the forces, tolerances, dimensions, and etc. in this area must be cleared through Test Equipment Engineering in Endicott to assess possible impact on the high speed, automatic handling equipment (SCFTS).

The card will be firmly seated in the housing at assembly.

OFF-LINE TEST EQUIPMENT

Class 4 Tester

The Class 4 Tester is designed to accommodate SLT cards which are designated as Class 4 (Suffix 10) or whose circuitry, although logic in nature, exceeds the previously defined electrical limitations of the SCFTS.

Electrical limitations:

1. The specified power supply accuracy shall not exceed ± 1.5%.

2. The number of different DC voltages used to operate the card circuitry shall not exceed 7.

3. For signal inputs greater than 1 volt, the minimum pulse width available is 50 ns and the maximum repetition rate is 10 mc.

4. For signal inputs whose amplitude is from 1 volt to a minimum of 1mv, the minimum pulse width is 30 ns and the maximum repetition rate, 1 mc.

5. The minimum output signal level is 1 mv.

6. The maximum output current is 2 Amps.

7. The output signal (voltage and/or current) can be checked to an accuracy of ± 3%.

Mechanical Limitations

1. All electrical contact to circuitry on the card is made through the SLT card pins.

2. Only standard SLT card sizes are acceptable.

3. Normal ground pins (D08 & J08) must not be used for circuit inputs or outputs.

4. Components cannot be physically below grid Y20.

5. Components on all five standard cards sizes cannot exceed .995 maximum in height.

6. Any components requiring screw adjustment must be mounted in such a way that they are accessible from the left card edge.

CABLE CARD TESTING

Equipment is presently available to test cable cards (Class 7 or 8). The following information will describe the different cable card configurations, both electrical and mechanical, which are acceptable:

Electrical Limitations

Class 7 cable cards (without components) with no components being present on this type of cable card, the only testing required is a continuity test between card springs and cable termination points. Class 8 cable cards (with components)

1. Only passive circuit elements (resistors, capacitors and clamp diodes) will be tested.

2. The maximum allowable test voltages applied to the card are ± 12V.

3. The maximum allowable test current used in verifying termination holes or lands is 200 ma.

Mechanical Limitations

A. Class 7 Cable Cards (cards without components)

1. Flat Cable Termination Type for single layer cable

a. 1.625" wide, .650 high, 21 tabs on back, 20 tabs on front and using housing 811304.

b. .750" wide, .650" high, 10 tabs on back, 9 tabs on front and using housing 811315.

c. .800" wide, .650" high, 10 tabs on back, 9 tabs on front and using housing 811617 or 811618.

d. 1.625" wide, .650" high(crossover tab configuration), 23 tabs on back and 22 tabs on front using housing 811304.

2. Flat cable termination type for double layer cables. All double layer cards are to be obsoleted and replace by cards defined in A-1; therefore, no ultimate test equipment is being built. There should not be any new releases with this tab configuration.

3. Discrete wire termination type.

a. Hole pattern must be on standard .125" grid starting with X 23, Y 23 and all X and Y grids ending in 3 or 8.

b. Cards can be a maximum of 1.460" high.

c. Cards can be a maximum of 1.625" wide.

d. Housings 811304, 811315, 811617, and 811618 can be used.

e. The card layout in panel form must be the same as the Standard SLT Logic Card Panel Layout so testing can be done on the Shorts and Continuity Panel Tester.

B. Class 8 Cable Cards (cards with components)

1. Flat Cable Termination Type for single layer Cable.

a. 1.625" wide, 2.150" high, 21 tabs on back, 20 tabs on front and using housing 811304. The minimum distance from cable tabs to nearest point on components is Y72 + .0125.

2. Flat Cable Termination Type for double layer Cable.

a. These double layer cable cards are to be replaced by those described in B-1; therefore, no ultimate test equipment is being built. There should not be any new releases with this tab configuration.

3. Discrete wire termination type.

a. Hole pattern must be on standard .125" grid starting with X 23-Y 23, and all X and Y grids ending in 3 or 8.

b. In panel form the card layout must be the same as the standard SLT Logic Card Layout so testing can be done on the Shorts and Continuity Panel Tester.

c. The standard cable terminating holes must be in the area bounded by grids X 23, X 78, Y 73 and Y 93. - For 1-12
X 23, X 78, Y 33 and Y 53 - For 1-6
X 23, X 43, Y 33 and Y 53 - For split 1-12 or 2-24

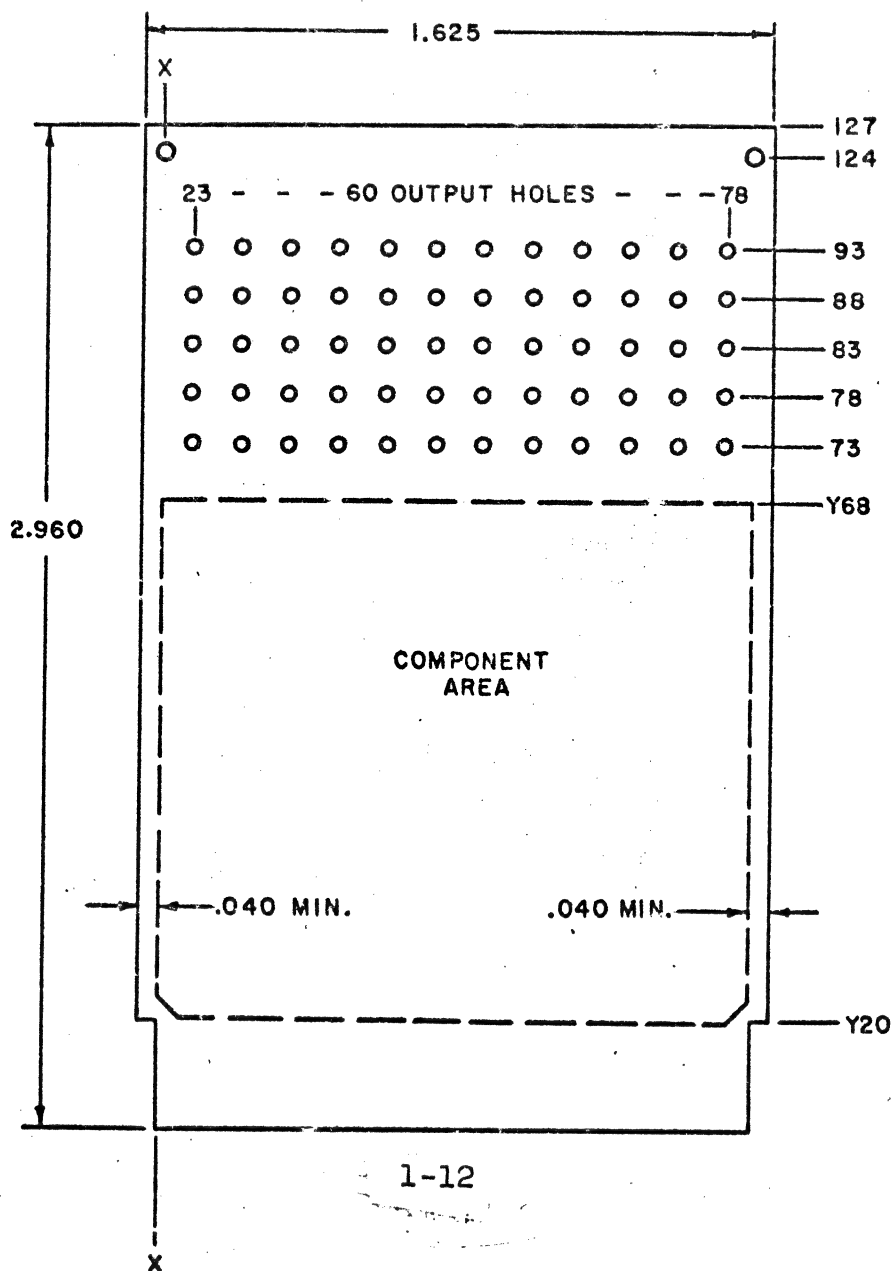
d. The components cannot be above grid Y 68 on 1-12 or 2-24 cards.

e. The 1-12 card will be 1.625" wide, 2.960" high and utilizing housing 811304.

The 1-6 card will be 1.625" x 1.460
The split pac will be .750 x 1.460

f. Special discrete wire cards will be defined as those that do not fall in above categories. This type must be cleared through Department 312. The tab configurations for flat cable are specified in Engineering Specifications 890911.

STANDARD DISCRETE WIRED CABLE CARDS (CONTINUED)

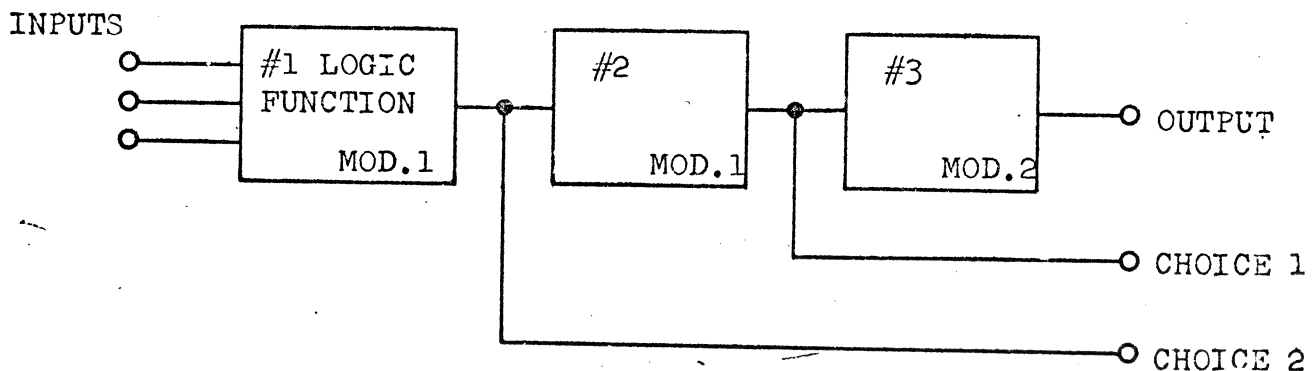
1.625
X
127
124
23 - - - 60 OUTPUT HOLES - - - 78
93
88
83
78
73
Y68
2.960
COMPONENT
AREA
.040 MIN.
.040 MIN.
Y20
1-12
X

TEST CLASS 8 (WITH COMPONENTS)

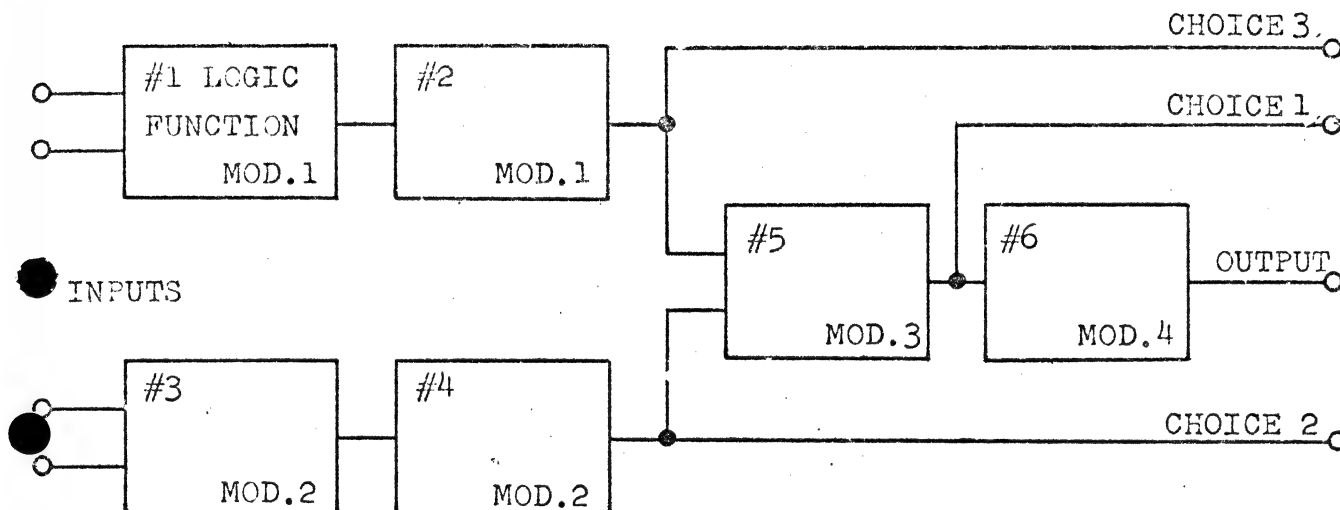
CIRCUIT DESIGN AND PACKAGING CONSIDERATIONS

Test Points Logic Circuitry

Test points are requested to ensure the best quality card at the most economical cost and for easier detection of faulty components. It would be desirable to have a test point brought out to a card spring for every transistor collector or emitter (on emitter followers). This is impossible many times because of pin limitations and speed and noise problems. Much can be done, however, to help with testing.

When assigning test points to a card, the purpose of these points should be kept in mind. As an example, suppose a card uses as part of its circuitry two logic functions which are contained in the same module. When these two functions are used in the same circuit, a test point between them would not be too beneficial. By looking at the final stage, it can be determined whether or not the module is faulty. The intermediate test point could therefore be used elsewhere. The block diagram below illustrates this.

INPUTS
#1 LOGIC FUNCTION MOD.1
#2 MOD.1
#3 MOD.2
OUTPUT
CHOICE 1
CHOICE 2

The first two logic blocks are in the same module and may or may not be the same type of function as block #3. If there is only one card pin available for a test point (TP) choice 1 would be the best. If the circuitry in either block #1 or #2 fails, it can be noted at TP choice 1; which part fails is of no concern since it involves only one module.

Another instance which could arise is as follows:

In this figure there are three choices for a TP if only one card pin is available. Choice 1 would be the best. If module one (Mod. 1) is faulty, sequencing its inputs will not operate block 5. Likewise, Mod. 2 being faulty will not function block 5. Using the proper sequence of inputs, the SALT programs determine whether Mod. 1 or Mod. 2 is faulty. If both of these modules appear faulty by looking at TP 1, it's probably neither Mod. 1 or 2 but Mod. 3 that should be replaced. This is also determined by the SALT programs. When Choice 1 is used with the output of block 6, a failure can be analyzed and pinpointed to any one of the four modules.

Class 4 Circuitry

Because the testing of Class 4 circuitry is more or less done by hand, it is desired to test as much as possible on CAFTS. SCFTS is very fast and the diagnostics for faulty components are accurate. If parts of a card can be tested logically, then this will allow the slower Class 4 equipment to ignore this portion of circuitry. If a failure occurs during Class 4 testing, only the remaining non-logic portion has to be examined. Likewise, if parts of the Class 4 circuitry can be tested on the SCFTS impedance tester, there will be fewer components which have to be considered for Class 4 failure analysis.

The best testing situation on a Class 4 card is when the logic portion is not connected to the Class 4 portion. This will allow SCFTS to completely test the logic portion while ignoring the Class 4. Likewise, the Class 4 portion will be completely tested on the Class 4 testers and the previously tested logic section can be ignored.

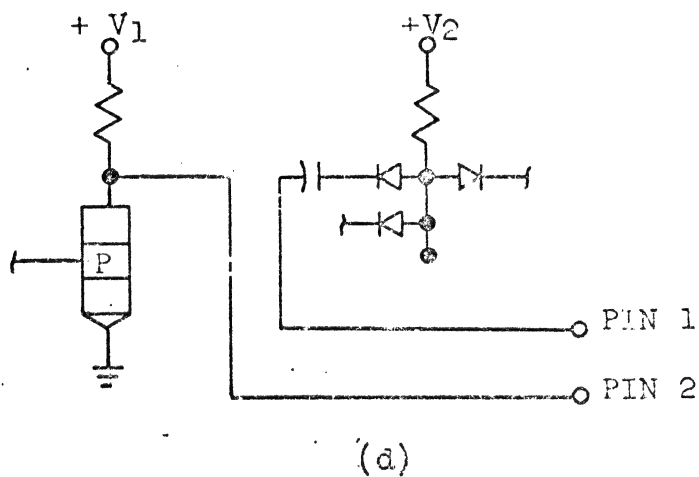
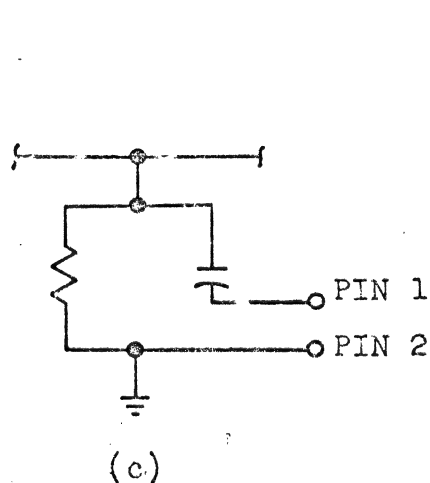
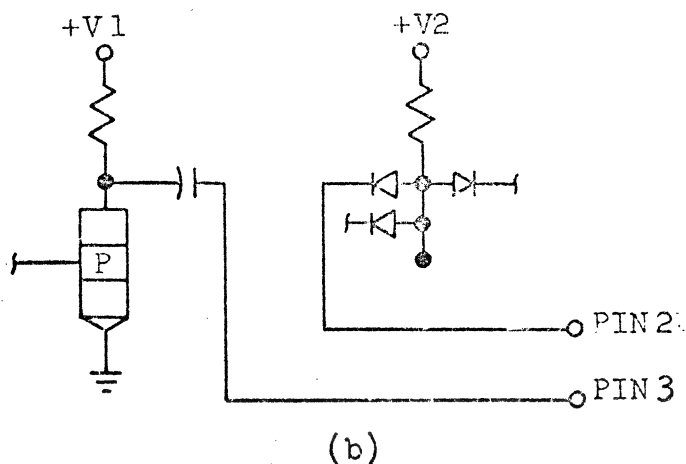
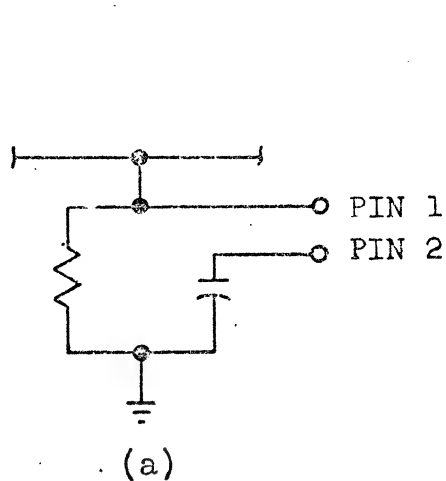
If complete isolation as described above is not possible, the next best situation would be a test point between the logic circuitry and the Class 4 circuitry. This will allow some logic testing on SCFTS, but it won't be as complete as the isolated logic Class 4 situation.

When neither of the above two uses of test points is possible or when there is no logic on the card, test points should still be chosen to enable SCFTS impedance testing to be done. In almost all instances impedance tests are made from card pins to a voltage or ground point. The following two examples illustrate a few instances involving capacitors.

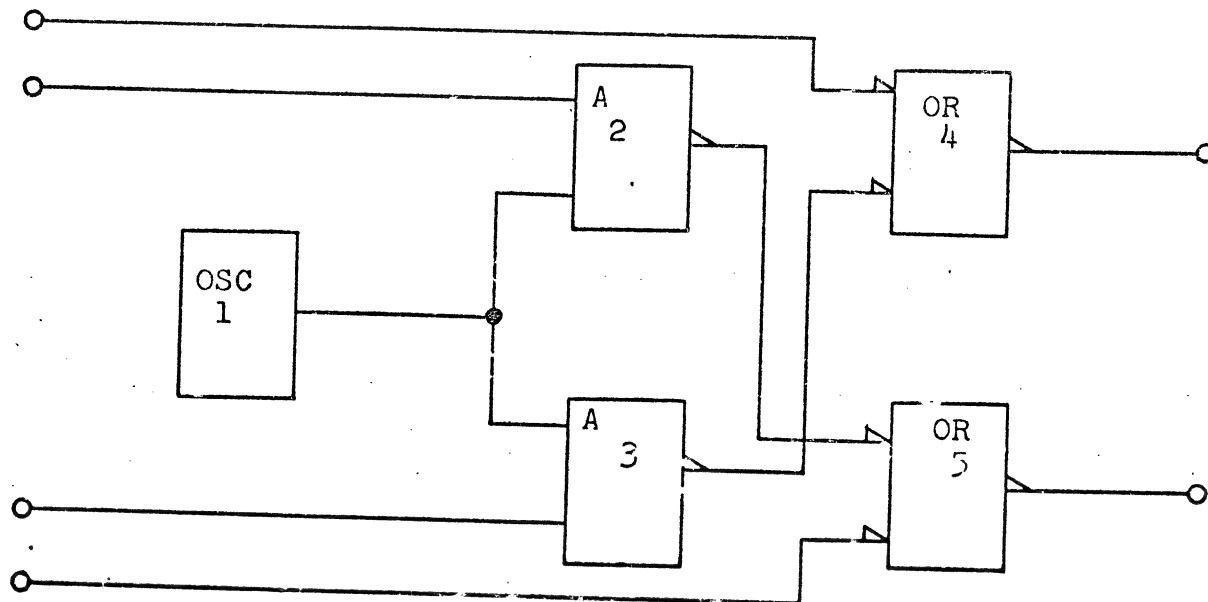
(a)

(b)

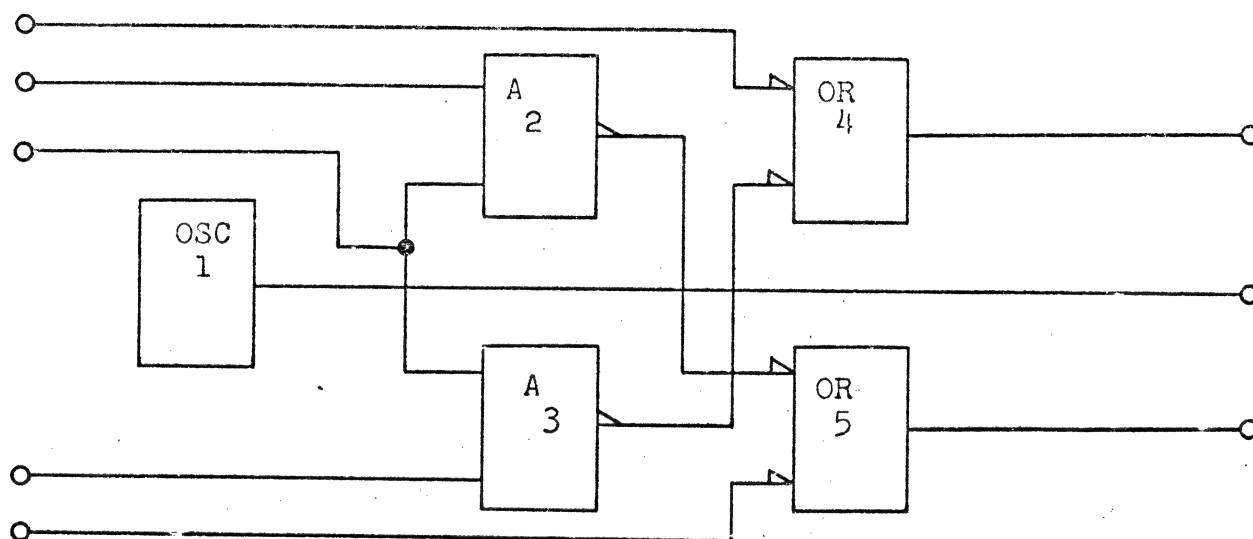
(c)

(d)

The first illustration of each case is the better choice. In (a) the capacitor is directly between a card spring and ground, but in (c) the capacitor is in series with an undefined network involving the resistor. In (b) and (d) the two logic levels (INVERT feeding an AND) are completely isolated from each other, which is desirable. However, in (d) an impedance test for the capacitor would have to go through a diode to $+V_2$. This test would involve the undefined network connected to the AND block. The test with configuration (b) is well defined as both ends of the capacitor are accessible from card springs. The "And" circuit and "Invert" circuit can also now be functioned logically.

When complete isolation is not possible as in figure (a) and (b), a single test point in most cases will still be useful.

Other and perhaps the most important examples of where separation of Class 4 circuitry from Logic circuitry is a definite aid to card testing, are as follows:

Poor

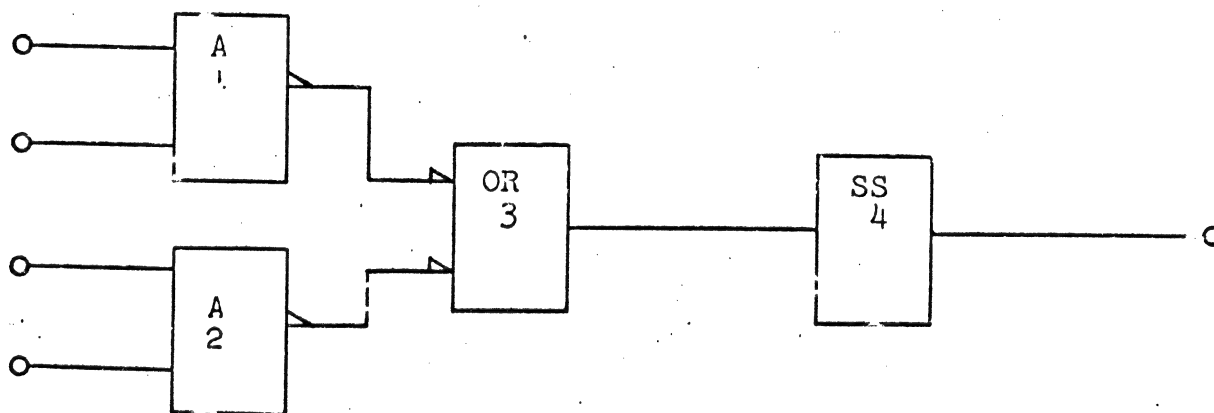
All circuitry must be tested on the off-line test equipment.

OSC 1
A 2
A 3
OR 4
OR 5

Good

The logic circuits 2, 3, 4, & 5 can be tested automatically on the SCFTS, leaving only the oscillator circuit to be tested on the off-line test equipment.

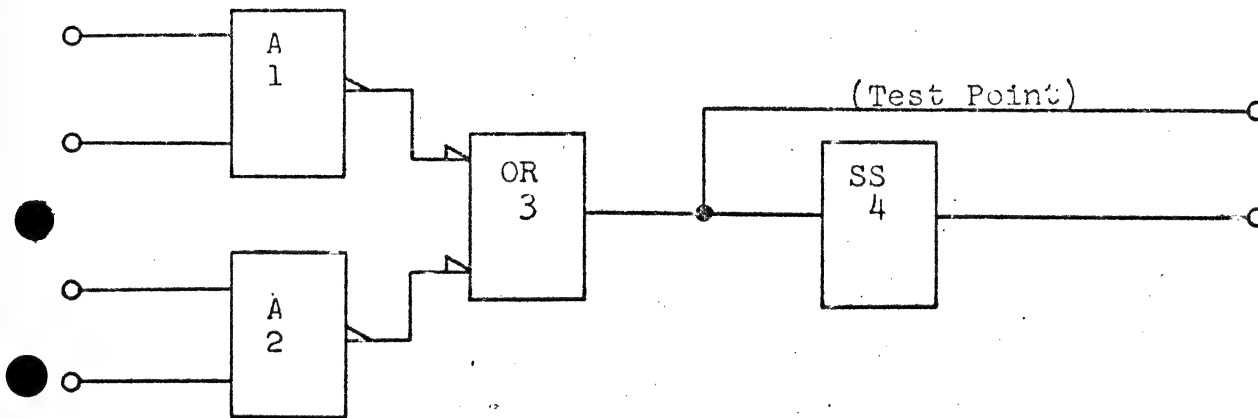
The best approach, however, is to avoid packaging Class 4 circuits, such as the oscillator circuit, on the same card with logic circuitry.

Example 2.

A 1
A 2
OR 3
SS 4

Poor

The entire circuit (blocks 1, 2, 3, & 4) must be tested on the off-line test equipment.

(Test Point)

A 1 — A 2 — OR 3 — SS 4

Good

The logic circuitry (blocks 1, 2, & 3) can be tested automatically on the SCFTS leaving only the Single Shot to be tested on the off-line test equipment.

The best approach again would be to avoid packaging Class 4 circuits, such as Single Shots, on the same card with logic circuitry.

Packaging

There are several circuit packaging conditions which should be avoided, if possible, as they are difficult to evaluate economically at final card test. These conditions are:

1. Parallel Circuitry

When parallel operation of transistors, modules, or diodes is essential to the proper operation of a circuit, the interconnection should be made on adjacent pins on the SLT board.

A
T03AB

(In)

OR
DOT

(Out)

A
T03AA

Poor

A
T03AB

(Out)

(In)

A
T03AA

(Out)

Good

Out

(In)

P

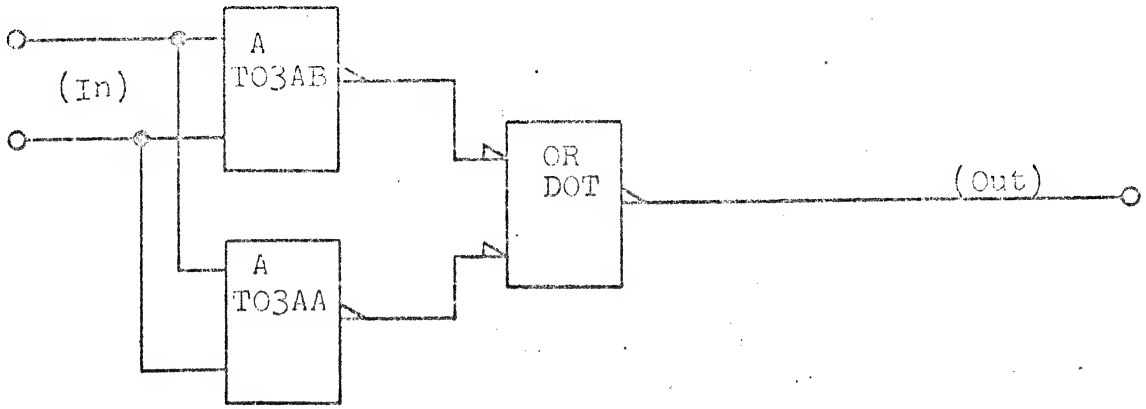
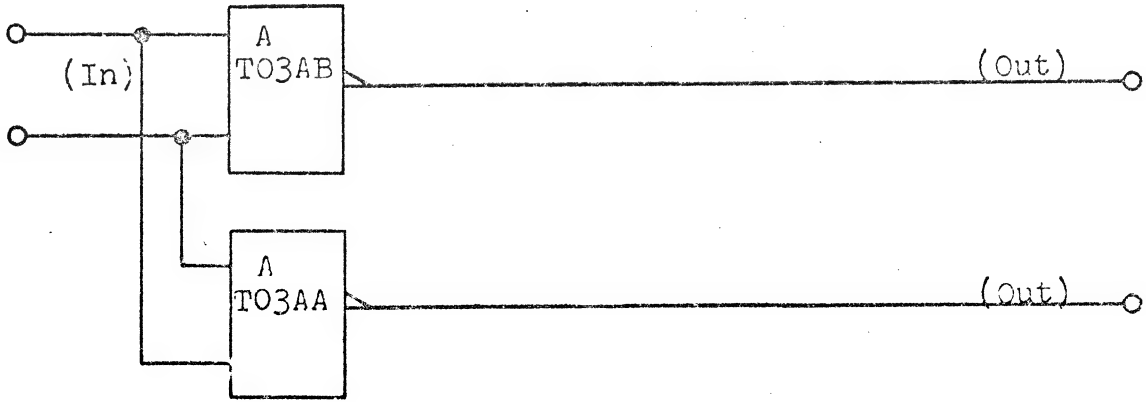
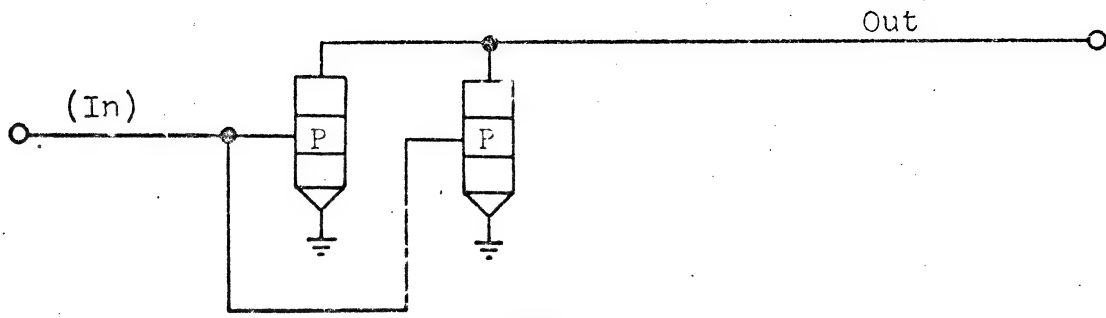
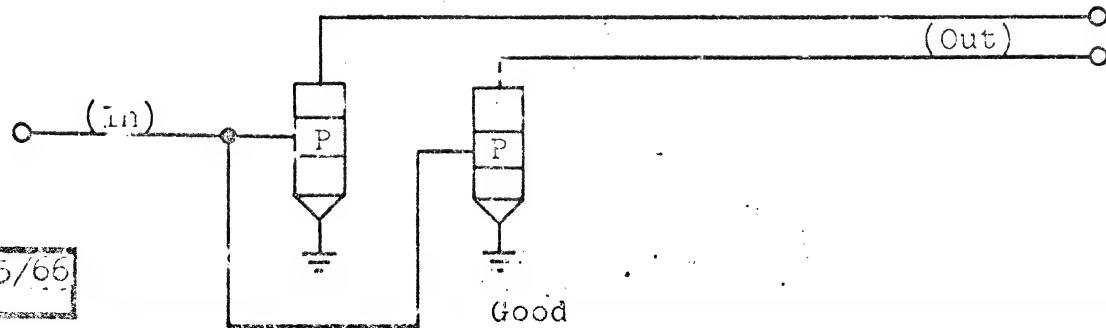
P

Poor

(Out)

(In)

P

P

Good

In the cases of parallel operation of the modules and transistors, one transistor could be faulty (open) and the remaining transistor could carry double load during test and be accepted as good. This "good" module or transistor could fail at a later time in the field because of this overload.

Out

P

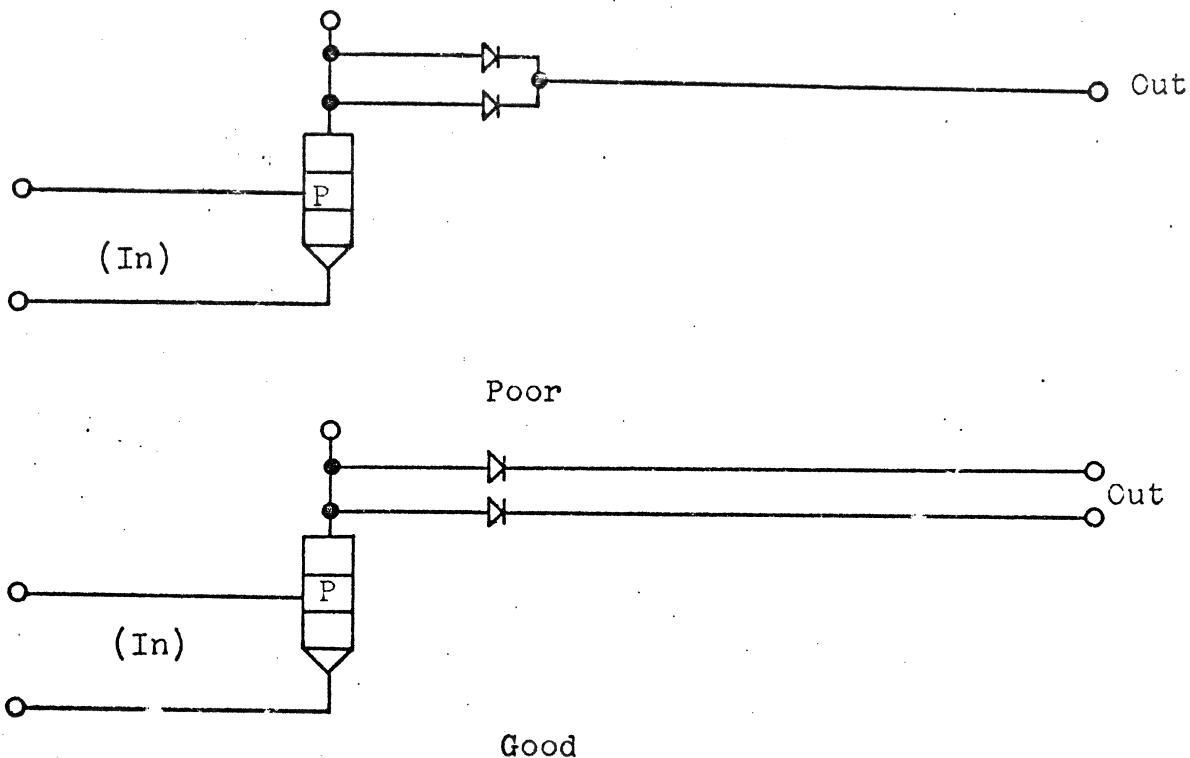
(In)

Poor

Out

P

(In)

Good

In the case when two diodes are paralleled in order to carry a greater current than the rating for one diode, it is possible for one to be open and the remaining diode to carry 200% of the load during the test and pass the manufacturing acceptance tests. This "good" diode could fail at a later time due to this overload.

2. Latches and Triggers

Each latch or AC input trigger circuit should have a DC reset line available to a card spring.

3. Special terminals

The use of signal terminating devices or locations other than standard card springs or those described in this section , under "Cable Terminating Cards Tester-Mechanical Limitations" must be avoided.

4. Arc Suppression Diodes & Relay Driving Circuitry

Arc suppression diodes must not be connected directly across relay coils nor should the relay driving circuitry be connected directly to the relay. Neither condition can be economically tested. It is better to separate one end of the arc suppression diode from the relay coil and the relay driving circuitry from the relay itself, thereby taking maximum advantage of automatic circuit testing on CAFTS.

CONCLUSION

SLT cards conforming with these rules and requirements can be tested, both in process and after final assembly, in the most economical manner utilizing presently available test equipment.

Cards not conforming with these rules and requirements may be subjected to excessive delay in the card release cycle, or shipped at a poorer quality level than anticipated It is therefore imperative that each card design conform, as closely as possible, to these rules and requirements.

IBM Division SLT SCHEMATIC DRAWINGS
Engineering Practice

SCOPE

This section will include the following:

Section	Section Title
23 A	SLT Completely Manual-Full Line Schematic Drawing
23 B	SLT ALD - Schematic
23 C	SLT Manual Block Schematic

SCOPE

This section defines the design, drafting, and checking requirements used in the SLT Completely Manual Full Line Schematic Drawing.

The latter portion fo this section outlines a procedure for checking the raw card and assembly documents (7094 computer output) against the formal schematic.

DESCRIPTION

Manual schematic drawings can be used for all SLT 580XXX card assemblies with components. The schematic sheets are part of the total package under the same assembly part number with the sheet numbers following in sequence the assembly drawing sheet(s). The titles and change numbers must agree with those on the assembly drawing. The change level code should be separated from the change number by a vertical line. See example below:

DATE	CHANGE	NO.
1-15-64	161626	A
5-23-64	163721	B

Formal (16xxxx) change numbers are followed by alpha codes.

DRAWING FORMS

Schematic sheets are cloth masters. The sheet size is "C" (17" x 22"). Schematic sheets may be horizontal (Form 82-001) or vertical (Form 620-8277) which is sourced in Endicott, Dept. 385.

CIRCUITRY

The circuitry on the schematic must agree with the circuit flyers and ALD. The preferred method of circuit layout follows the module structure which is more meaningful when servicing an SLT card. The circuitry of SLT modules in their preferred structure is shown in Section 10 of Suffix 3.

In the case where a module has two internal diodes in parallel, but the circuit flyer only shows one, the module representation should be shown when drawing the schematic. This is the only exception to the rule "the circuitry on the schematic must agree with the circuit flyers and ALD".

Each logic block on the ALD (automatic logic diagram) has a symbolic electrical representation. This representation is shown on the corresponding circuit flyer (ex. V03AA, V05EK, etc.). The location of the symbolic representation should be similar to the location of the logic blocks on the ALD. In other words, the electrical symbols representing circuit components and the associated interconnecting lines should be grouped on the schematic drawing in such a way that the functional operation of the card circuitry involved may be easily followed.

In general, this requirement can be met by adhering to the following suggestions:

Keep all of the electrical symbols and interconnections for a particular circuit in a group.

Inputs to and outputs from individual circuits should enter from the left and exit to the right of the associated symbolic group.

Avoid circuit line crossovers wherever possible.

When assembling the individual circuit symbolic groups on the schematic drawing, use the logic block representation on the card ALD as a guide.

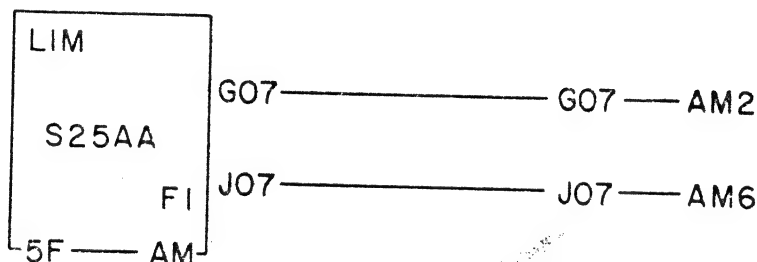
CIRCUITRY INDENTIFICATION

Each portion of the schematic representing the circuit flyer should be identified. The schematic circuitry for each ALD logic block will be identified by the circuit flyer I. D. and the portion and sub-portion code located on the ALD logic block. The protion and subportion codes are printed in a .500 diameter circle and are located once for each logic block on the schematic near the associated circuitry. See below and also Figure #1.
Portion and sub-portion code found on ALD logic blocks.

.500 A1 B2 C3 AA

COMPONENT DRAFTING REQUIREMENTS

Lettering of part numbers should be with a .140" template or with the IBM Typewriter #8 manifold. Inking of components will be done with K&E template #2140; penciling of components will be done with template Form 45296. Codes for modules (R/C or SLT), diodes, resistors, transistors, and other components should be obtained from the assembly drawing of that particular SLT card. Component size must be consistent throughout the schematic sheets. The component symbols are shown according to the circuit flyer.

An ALD representation of a logic block is shown below. The logic block contains the circuit flyer I. D. part number (S25AA) and the portion and sub-portion code (F1).

When the schematic is drawn to represent the electrical equivalent for the above logic block, the Circuit-Flyer I. D. and Portion and Sub-Portion code are used to locate and identify the circuitry.

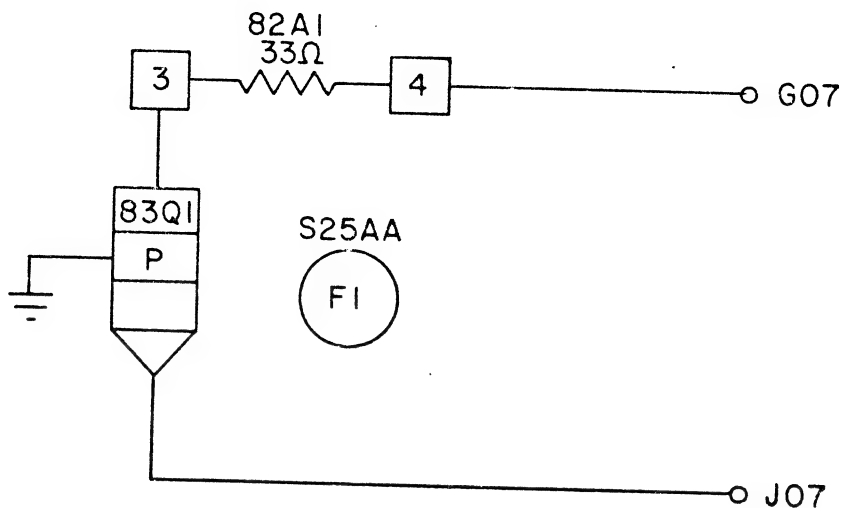
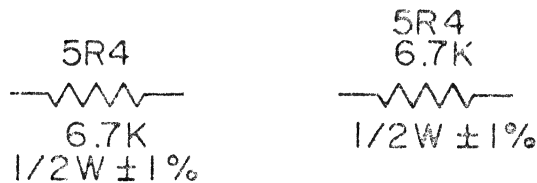
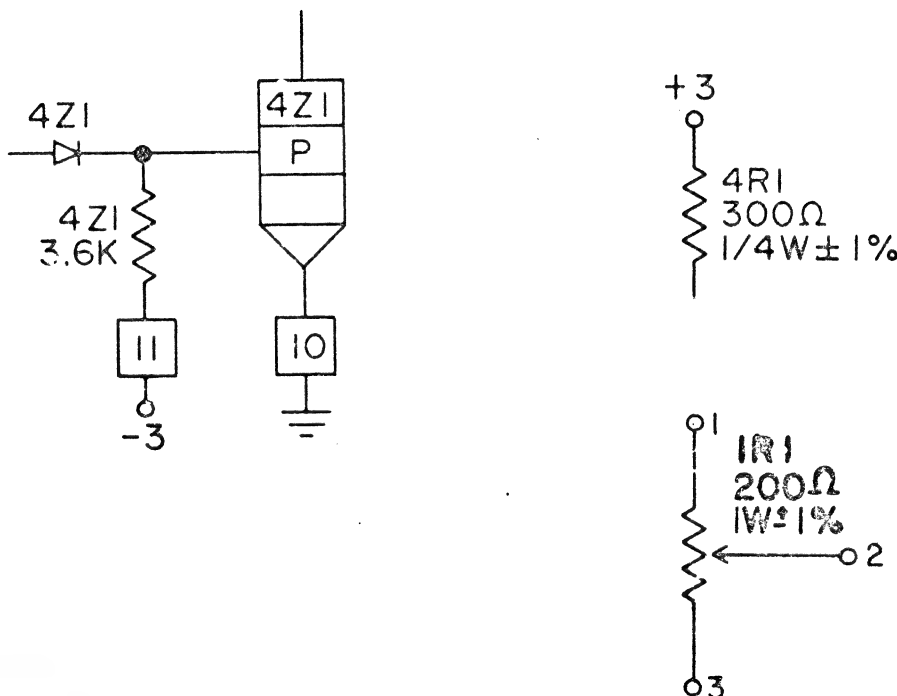



Figure #1

DISCRETE COMPONENTS - General

Components drawn in a horizontal position carry their locations and values either directly above or directly above and below with the component location always at the top, followed by the value, etc.

For vertically drawn components the location and value is on either the right or left side, but not split.

Resistors-Resistors within modules are coded with the module location identification and their ohmic value. Discrete resistors are coded with their assembly identification, wattage, ohmic value and tolerance.

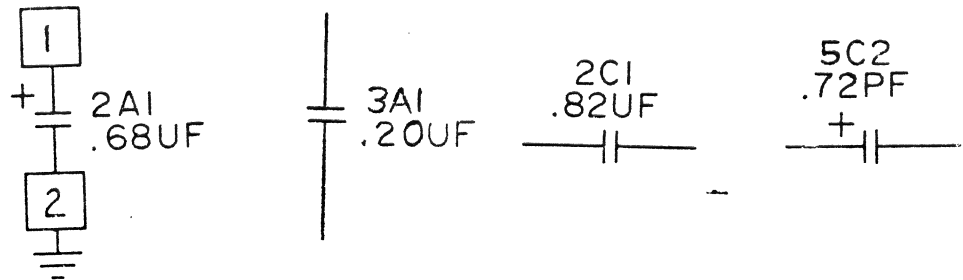
An example of resistor designations is as follows:

SLT Completely Manual
Line Schematic Drawing

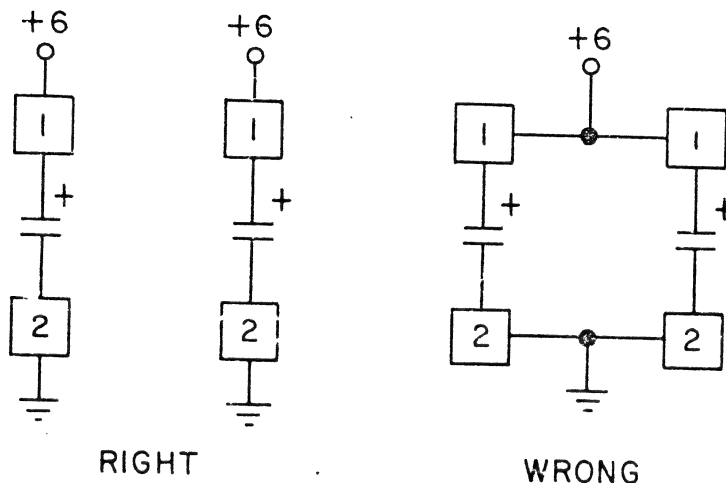
Capacitors

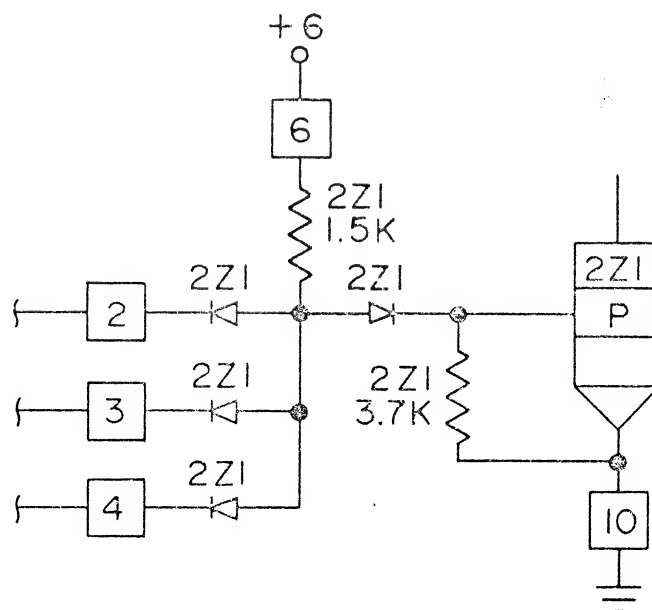
Location coding in R/C modules is that which appears on the associated assembly drawing (ex. 5A1, 2A2) plus the capacitance (182uf, 12pf).

Discrete capacitors are coded as on the assembly drawing for the associated capacitors (ex. 1C1, 5C2) plus the capacitance value. Polarized capacitors must have their positive and identified with a + sign.

Two-leaded, non-polorized R/C Modules will not have the pin locations shown as in the example below (3A1).

Example:

Filter capacitors must be indicated with pin blocks when they are R/C modules (ex. 2414883).*

* Filter capacitors must not be bussed.

Diodes

Diodes are found in SLT modules as discrete components or in diode pacs. In SLT modules, diodes are coded with the SLT module identification. (ex. 2Z1, 3Z2.) Each diode in the module must be coded individually with this identification. Discretes are coded with CR such as 3CR3, 2CR2. Diode pacs are coded CR also.

Types of diodes and their representation are as follows:

Transistors

Transistors are found in SLT modules and as discretes. Code transistors inside the SLT modules with the module identification part number (ex. 24Z3, 12Z1). This number should be located within the collector portion of the transistor. "P" or "N" (representing NPN or PNP type) is located within the base portion of the transistor.

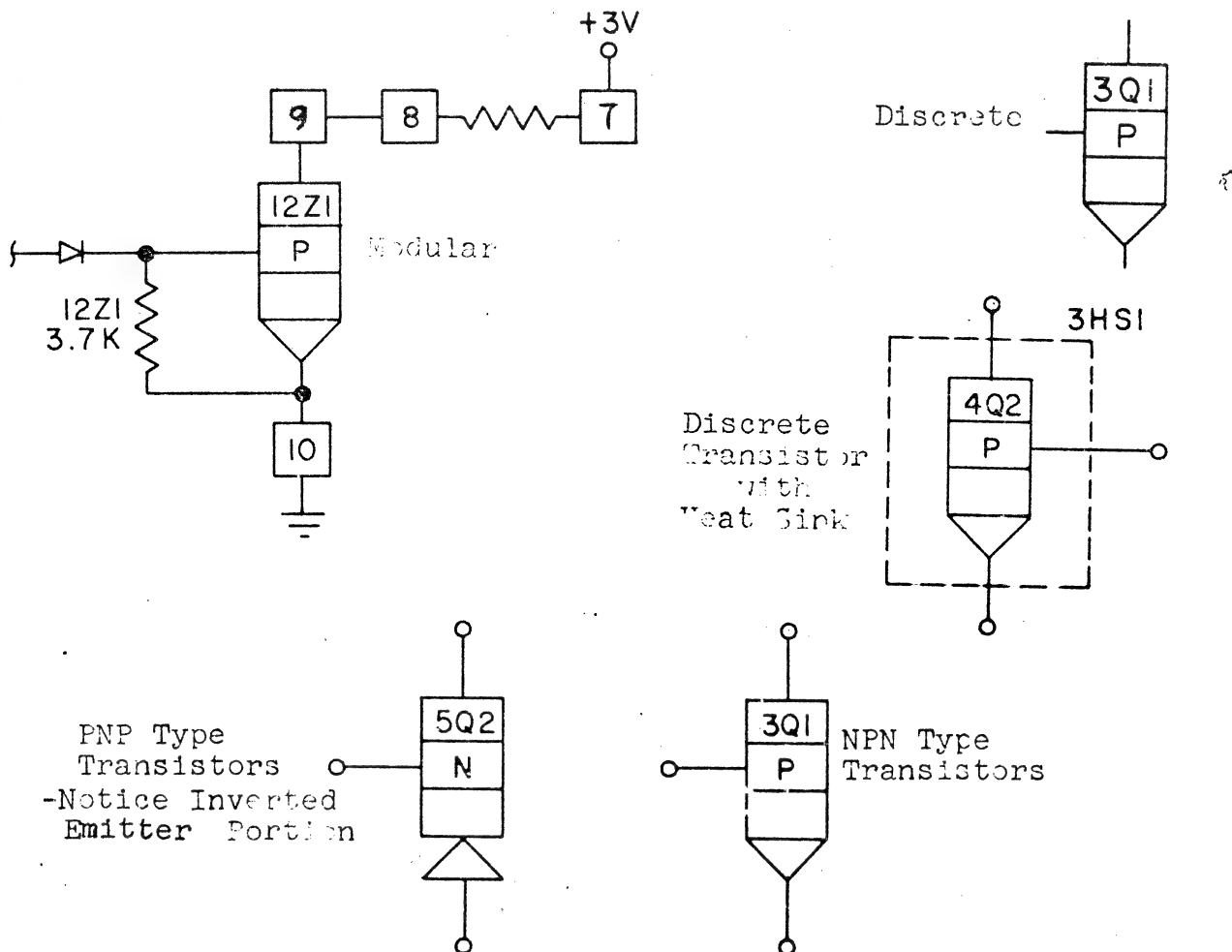
On discretes the coding is as on the assembly drawing for that card. (discretes are coded with a Q) ex. 3Q1, 4Q2.

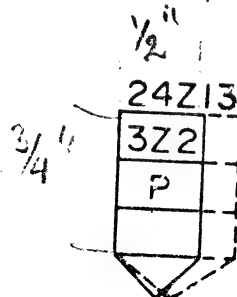
+3V
9
8
7
12Z1
P
Modular
12Z1
3.7K
10

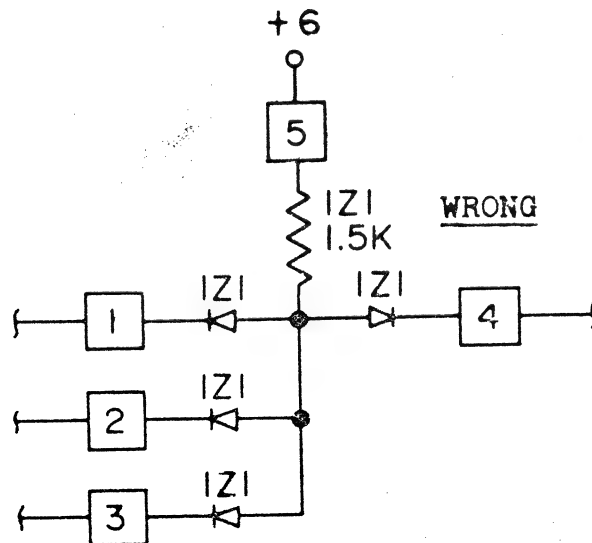
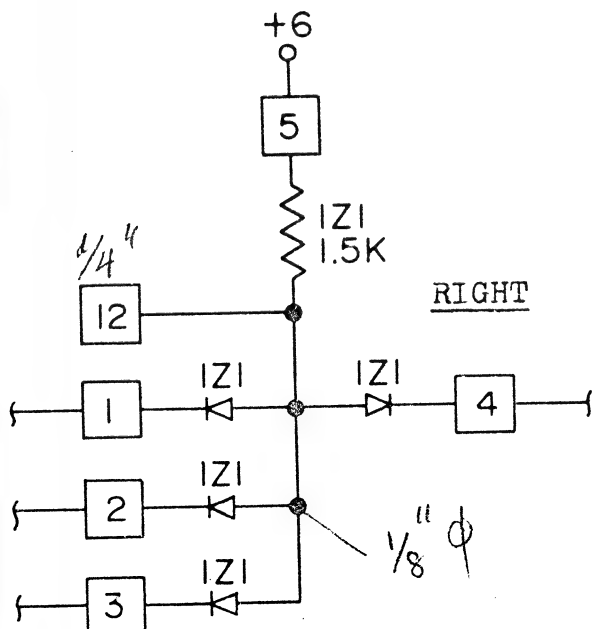
Discrete
3Q1
P

3HS1
4Q2
P
Discrete Transistor with Heat Sink

PNP Type Transistors -Notice Inverted Emitter Portion
5Q2
N

3Q1
P
NPN Type Transistors

Indicate transistors with a 1/2" x 3/4" rectangle unless the component part number requires a larger size. Example:

1/2"
24Z13
3/4"
3Z2
P

SLT MODULES

The preferred method of drawing the most commonly used modules is shown in Section 10 of Suffix 3. Every component within the module must be coded with the module assembly identification (ex. 12Z3, 2Z1). Enclose all component pin numbers in a $\frac{1}{4}$" block. Pins which are used as extenders are to be shown. This is valuable for testing information.

Other components drafting requirements which are not indicated in the previous material may be obtained from IEP.0-1035-0. All pins must be shown whether they are used or not. Connections within the module are made with an 1/8" dot and should not be made to pin blocks. Component sizes within the module are described in the preceding material.

UNUSED COMPONENTS

All unused discrete or unused individual circuits within a module must be grouped together on the last schematic sheet under the title "Unused Components."

LINE SYMBOLS

Input-Outputs

All inputs must enter at the left side of the schematic sheet. All outputs must leave on the extreme right of sheet. Terminate input-output lines with an 1/8" circle.

B02 D06

Line Intersections

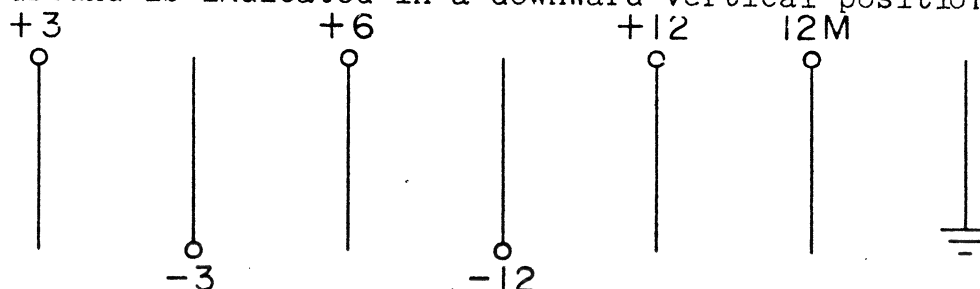
Electrically common line intersections are to be shown with an 1/8" dot at their intersection.

Line intersections with no electrical connection shall be shown with no dot at their intersection.

Voltage Designations

All voltage and ground connections will be shown in a vertical direction. Positive voltage are shown upward and negative voltages downward. The only exception to this is for filter capacitors when -3 for example, is filtered to ground. The -3 designation would be shown in an upward vertical position. Ground is indicated in a downward vertical position.

+3 +6 +12 12M

-3 -12

The "V" is not required after the voltage quantity. Example: +3 or -3 is preferred over +3V or -3V. When using +12 marginal voltage the "M" must be shown since it identifies this voltage from the usual +12. Indication of the +12 marginal voltage will be 12M.

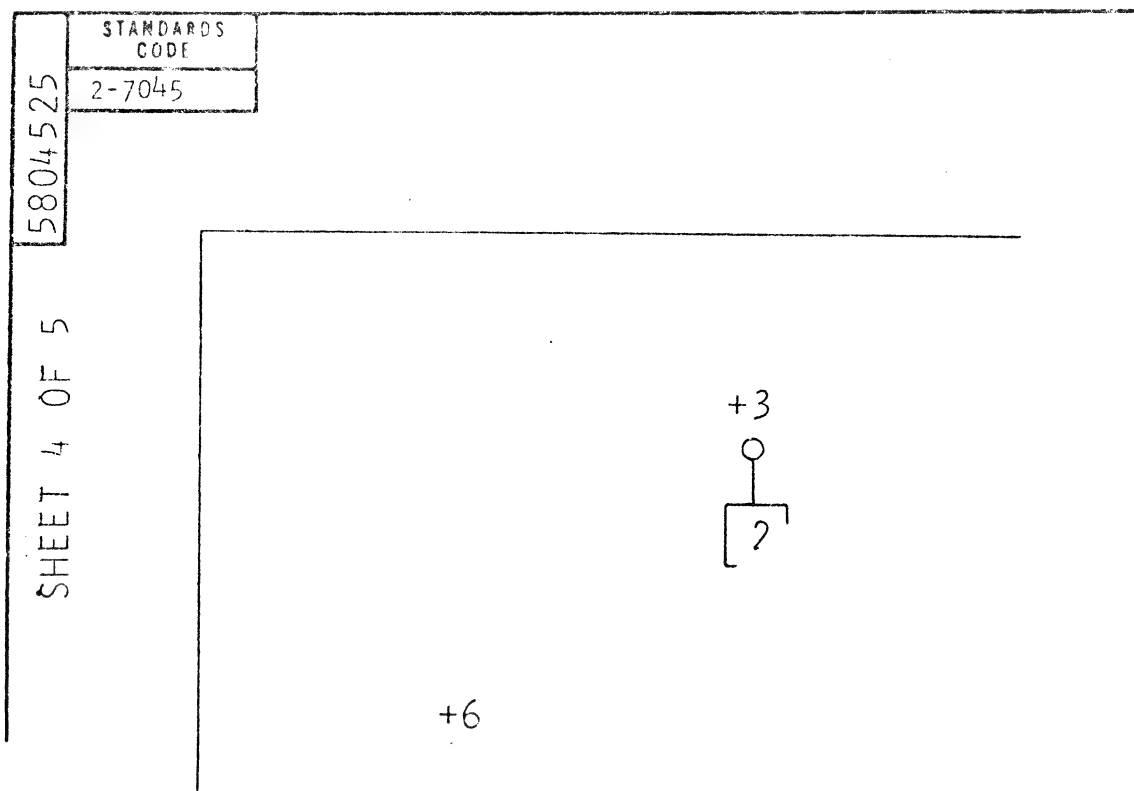
Bussing representation of voltages or grounds is not allowed. Each voltage or ground connection will be shown with a separate appropriate symbol.

Schematic Numbering Sequence

Identification or sheet numbering - Since the schematic sheets are part of the assembly package they must be included in the total number of assembly documents. The ALS(s) are numbered first, assembly sheet(s) second, and the schematic sheet(s) third.

Example: Assembly 5806010 may have one ALD (sheet 1 of 3), one assembly drawing (sheet 2 of 3) and one schematic sheet (sheet 3 of 3). Whereas, Assembly 5806011 may have two sheets of ALD, two sheets of assembly drawing, and three schematic. Since the total assembly package contains 4 automated documents and 3 manual documents or 7 total documents the numbering would be as follows:

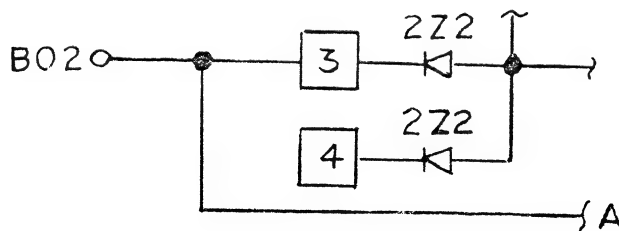
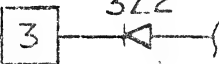
> The ALDs would become sheets 1 of 7 and 2 of 7. The assembly sheets would become sheets 3 of 7, and 4 of 7, and the schematics would become sheets 5 of 7, 6 of 7, and 7 of 7.

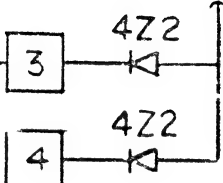
The sheet number designations will be shown readable along the upper left side of each schematic sheet.

CROSS REFERENCE BETWEEN SCHEMATIC SHEETS

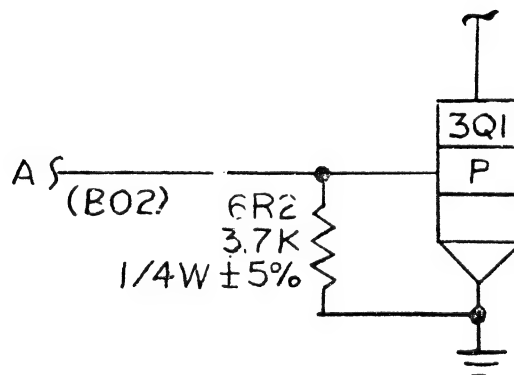
Lines indicating connections between pages should be brought out to the extreme right or left side of the schematic sheet. These lines should be terminated with breaklines. The breaklines are labelled from "A" to "Z" (top to bottom) and then "AA" to "ZZ" beginning on the first sheet of schematic. Do not use letters I or O when labelling breaklines.

If a signal pin from one sheet of schematic goes to other sheets of schematic, the breaklines on the schematic sheets will have the signal pin printed in parenthesis below them. The cross referencing must then be done as shown below.

Sheet 3 of 6

B02 — 3 — 2Z2 — 4 — 2Z2 — A

Match with A sheets 4, 5, 6 of 6

Sheet 4 of 6

Match with A sheets 3, 5, 6 of 6

A (B02) — 6R2 3.7K 1/4W ±5% — 3Q1 P

Sheet 5 of 6

Match with A sheets 3, 4, 6 of 6

A (B02) 3 3Z2

Sheet 6 of 6

Match with A sheets 3, 4, 5 of 6

A (B02) 3 4Z2

4 4Z2

NOTES ON SCHEMATICS

Notes on schematics should be avoided wherever possible. If notes are used they will be on the first sheet.

Accepted notes which have become necessary for release procedures are bussing notes. The bussing note is put on the first sheet of schematic near the bottom and aids testing personnel in their evaluation of the card.

A bussing note is required in all cases where a service voltage enters a card on more than one card spring contact and is used in conjunction with the cards circuitry. In general, two (2) socket wide cards require a bussing and one (1) socket wide cards do not; but the preceding definition will take precedence.

If no pins are bussed state:
"NOTE--NO BUSSING CONDITION"

The standard bussing notes are as follows:

```
+3 --   D03, J03 Bussed       }
-3 --   B06, G03   "          }  Standard note for most
+6 --   B11, G11   "          }  30NS family
GND--   D08, J08   "          }

+12  - D03, J03 Not Bussed    }  Standard note for 700NS
+12M - B11, G11 Not Bussed    }  2 socket cards with
GND  - D08, J08 Bussed        }  ground plane

+12  - D03, J03 Not Bussed    }  Standard note for most 700NS
+12M - B11, G11 Not Bussed    }  2 socket cards.
GND  - D08, J08 Not Bussed    }
```

SLT SCHEMATIC DRAWINGS
SLT Completely Manual Full
Line Schematic Drawing

Notes such as:

"ALL RESISTORS ARE $\frac{1}{4}$W ± 5% UNLESS OTHERWISE SPECIFIED" are acceptable on schematic drawings.

Figurès 2 through 9 will illustrate the procedures necessary for the design of a schematic.

Figure 2 shows the ALD. The ALD contains the logic block portion and sub-portion-codes, circuit flyer I.D, Signal inputs and outputs, and other information necessary for schematic design.

Figures 3, 4, and 5 show the circuit flyers used for reference when designing the schematic on the circuit flyers are listed.

Figure 6 shows the modules selected from the previous circuit flyer choices. These modules will be used for the card layout and are indicated on the schematic.

Figures 7, 8, and 9 show the completed schematic incorporating the rules we have just defined.

CONCLUSION

Since the schematic portion of a released assembly package is manually drawn, it is most important that they be neat, legible, and reproducible, as well as being electrically correct. This section has defined the rules for the design and drafting of card schematic drawings.

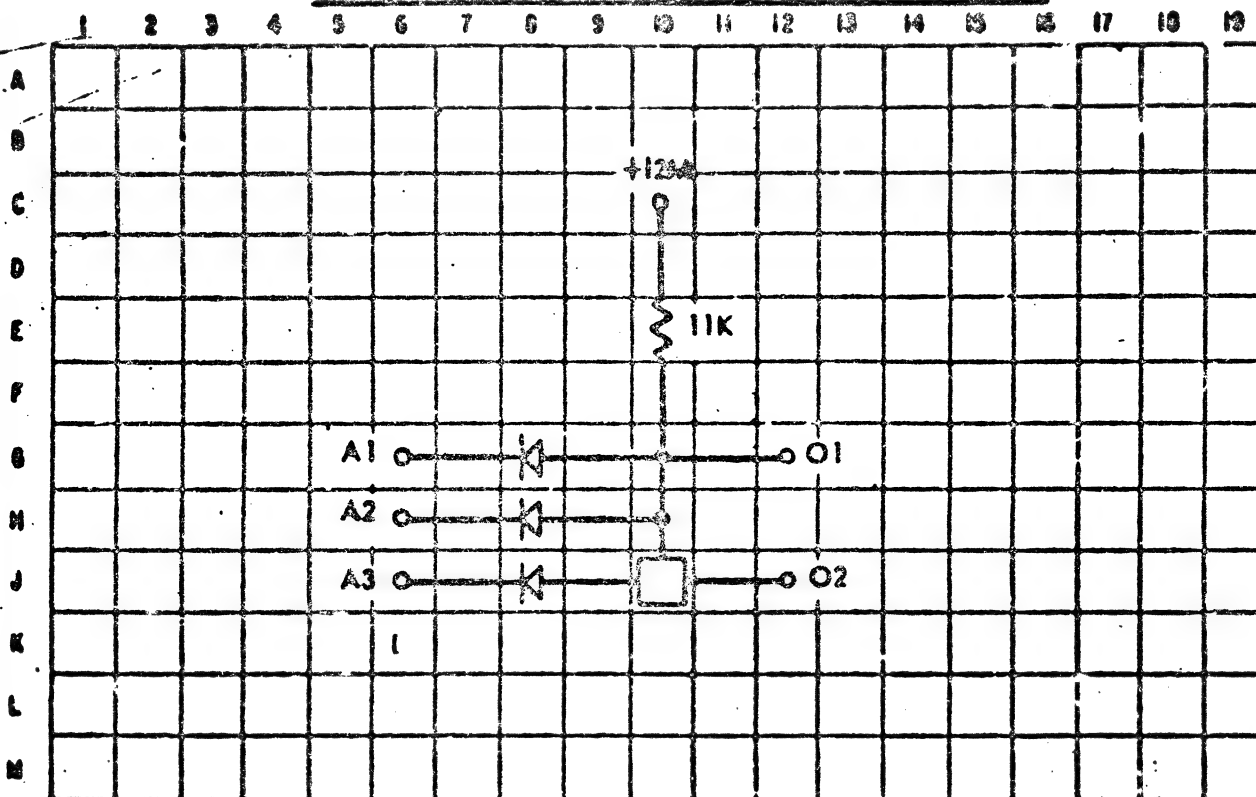
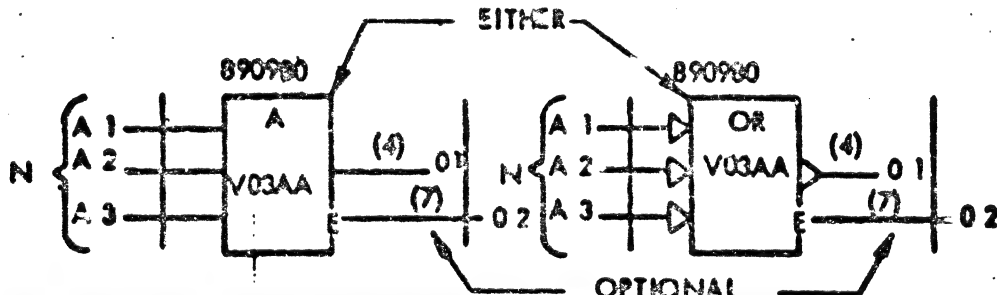
Figure #2

IBM ENGINEERING SPECIFICATION

PART NO. 873000
BLOCK ID. V03AA
SRETL 700 TITLE AND (FOR AI/AOI)
PAGE NO. 001.00 of 003.00

REFERENCE: CIRCUIT SPEC 890980

BLOCK CLASS STANDARD CONTROL CODE PC (873067)
BLOCK STATUS RESTRICTED GROUPING V03VA, (873065), V03VC,
PACKAGING

ALL COMPONENTS ARE CONTAINED WITHIN
SLT MODULES - 361493 (R), 361495 (R), 361489 (R),
361499 (R), OR 361496 (R)
R=RESTRICTED COMPONENT

DESIGN AUTOMATION BLOCK REPRESENTATION

N = 1 TO 19 INPUTS 1 (THE SPECIFIED DELAYS APPLY WITH N=10)

PART NO. 873000

D.A. APP. H.TSANOS	R + S APP. L. BEARNSON	
MADE BY H. KLOPP	ENG. APP. E.F. HAHN	TECH. AP. H. GELLES; E.C. LEVEL 751218

IBM CIRCUIT FLYER

PART NO. 874837
BLOCK ID. V03EP
PAGE NO. 001.00

TITLE 2-WAY AI-5K

BLOCK CLASS STANDARD
BLOCK STATUS RESTRICTED
PACKAGING ALL COMPONENTS ARE CONTAINED IN SLT MODULE 361445
CONTROL CODE ED
GROUPING NONE

DESIGN AUTOMATION BLOCK REPRESENTATION

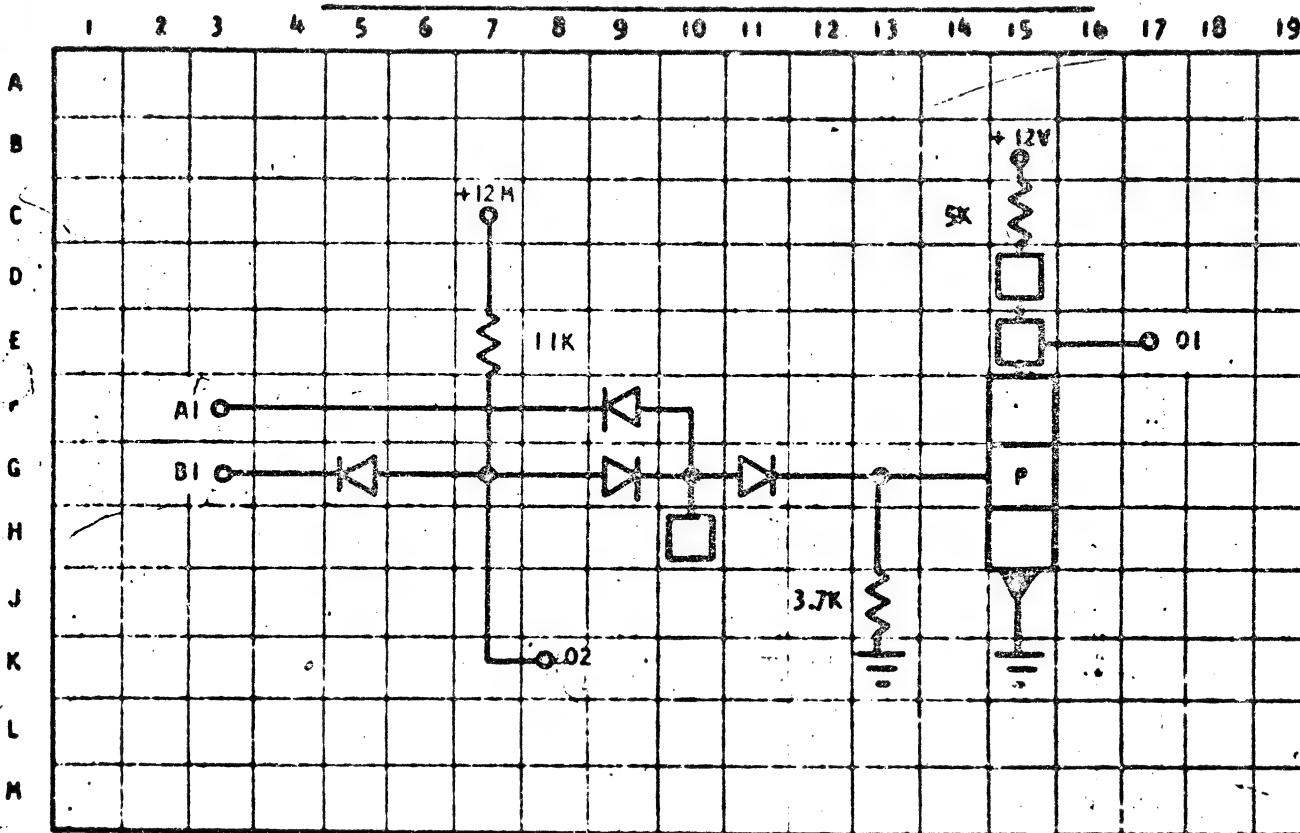
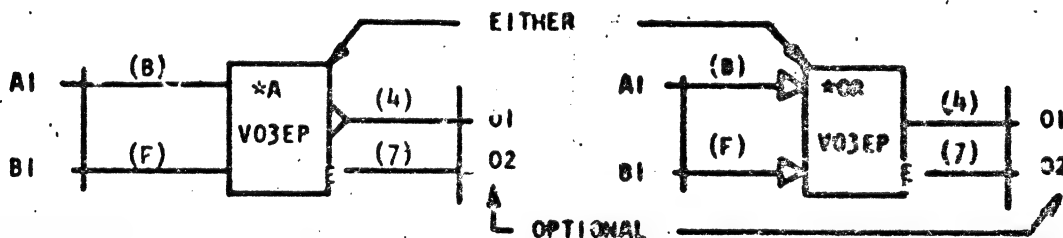
PART NO. 874837

REF.CKT.SPEC.P/N 390980		E.C.	DATE	E.C.	DATE
MADE BY G.ROHRER	ORIG.APP. G.D.R.	165543			
TECH.APP. WJR	R&S APP.				
DA.APP. D.PETRANICK	I.E.APP. E.Jenkins				

Figure #4

IBM CIRCUIT FLYER

PART NO. 074025
BLOCK ID. V03EN
PAGE NO. 001.00

SRETL-700 | TITLE OR INVERTER-5K 2-WAY AI

BLOCK CLASS STANDARD — CONTROL CODE ED

BLOCK STATUS RESTRICTED — GROUPING NONE

PACKAGING M1 = SLT MODULE - 361445

M2 = SLT MODULE -361489 OR 361495

NOTES I, USE 361489 OR 361495 TO EXTEND THE OR FUNCTION ABOVE (1)

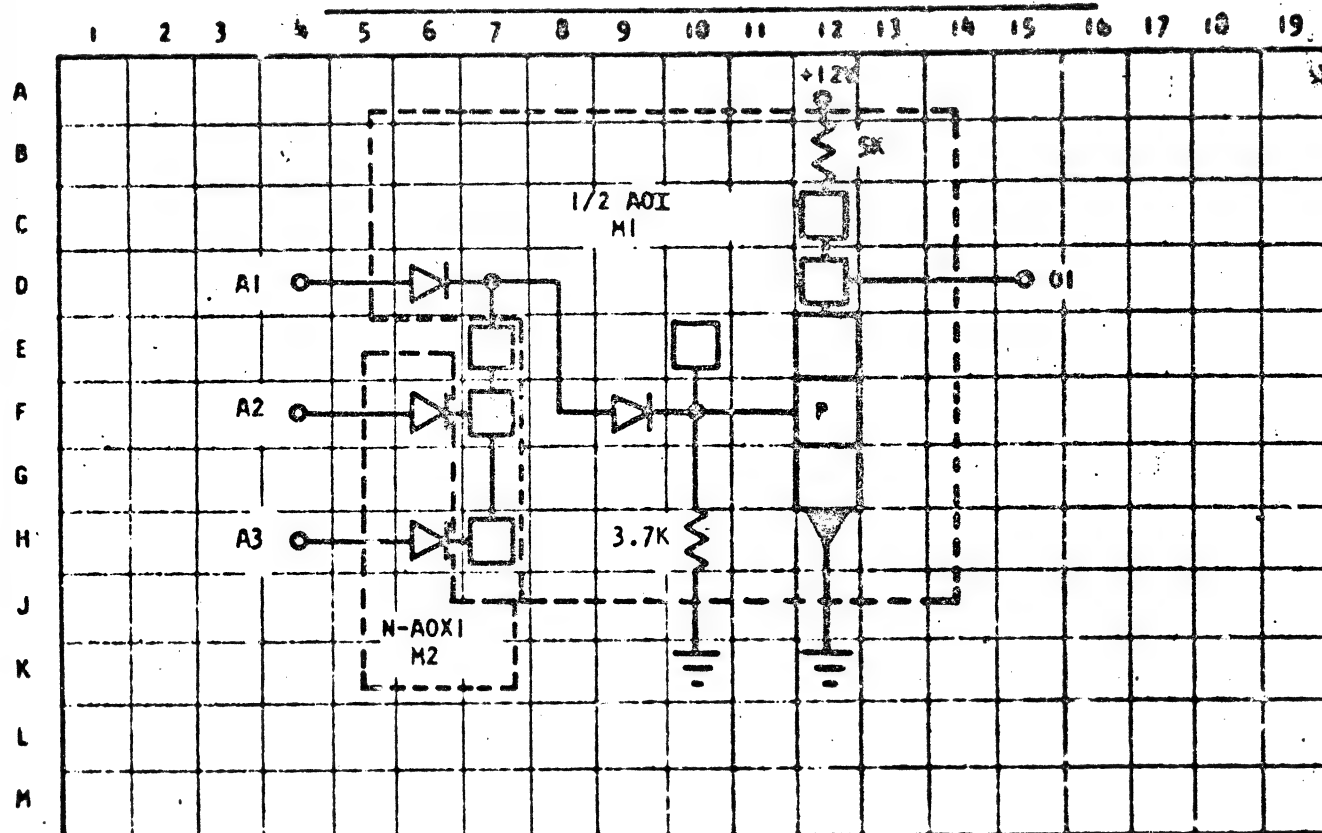
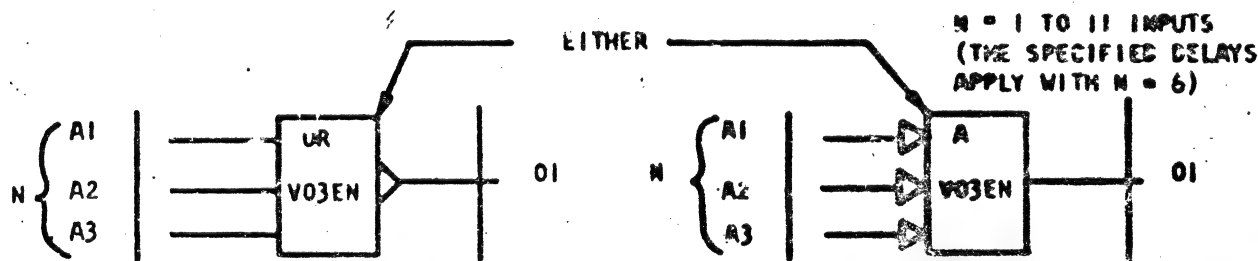
+12V
5K
1/2 AOI M1
A1
A2
A3
O1
P
3.7K
N-AOXI M2

DESIGN AUTOMATION BLOCK REPRESENTATION

EITHER

N = 1 TO 11 INPUTS (THE SPECIFIED DELAYS APPLY WITH N = 6)

N { A1 A2 A3 — OR V03EN — O1

N { A1 A2 A3 — A V03EN — O1

PART NO. 074025

REF.CKT.SPEC.P/N	890980	E.C.	DATE	E.C.	DATE
MADE BY G. Rohrer	ORIG.APP. GDR	165543			
[illegible] APP. WJR	R&S APP.				
	T.E.APP.				

Figure #5

Figure #6

SLT Completely Manual Full Line Schematic Drawing

A1 V03EP
A2 V03EP
A3 V03EP
A4 V03EP
A6 V03EP
A7 V03EP
A8 V03EP
A9 V03EP

B12
D12
D13
D02
B13

(D04)
(B09)
(D09)
(D06)

SE 015

Figure #7

SHEET 4 OF 5

Figure #8

5801634
2-7045
SHEET 5 OF 5
+12M
+12
AS
V03EP
5Z2
11K
5K
3.7K
A
B08
805
AA
AE
AF
AK
AL
V03AA
9Z2
4Z1
8Z3
J
M
(B02)
H
D07
D06
K
D05
L
(B04)
UNUSED COMPONENTS
SE OF 5
C

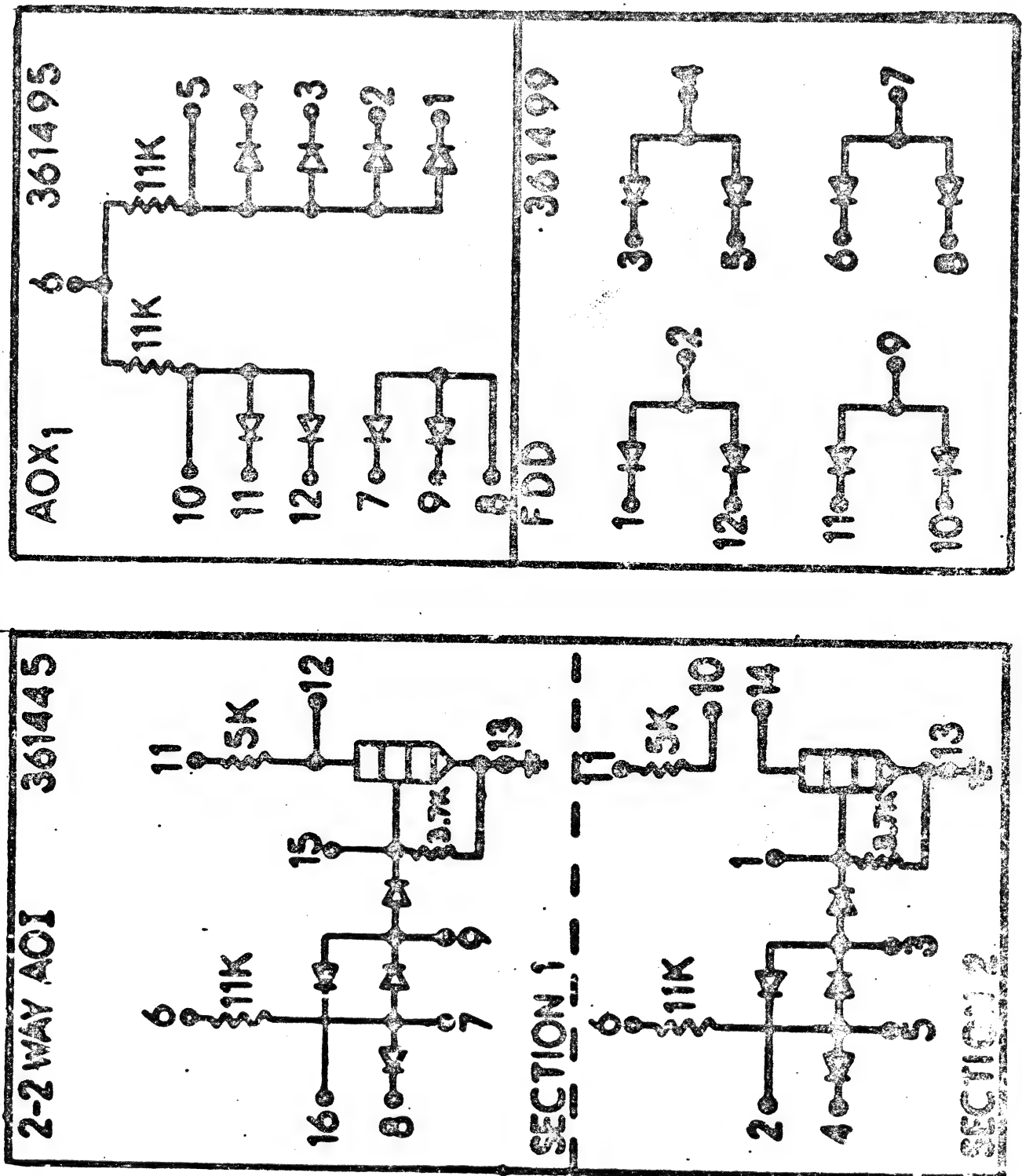
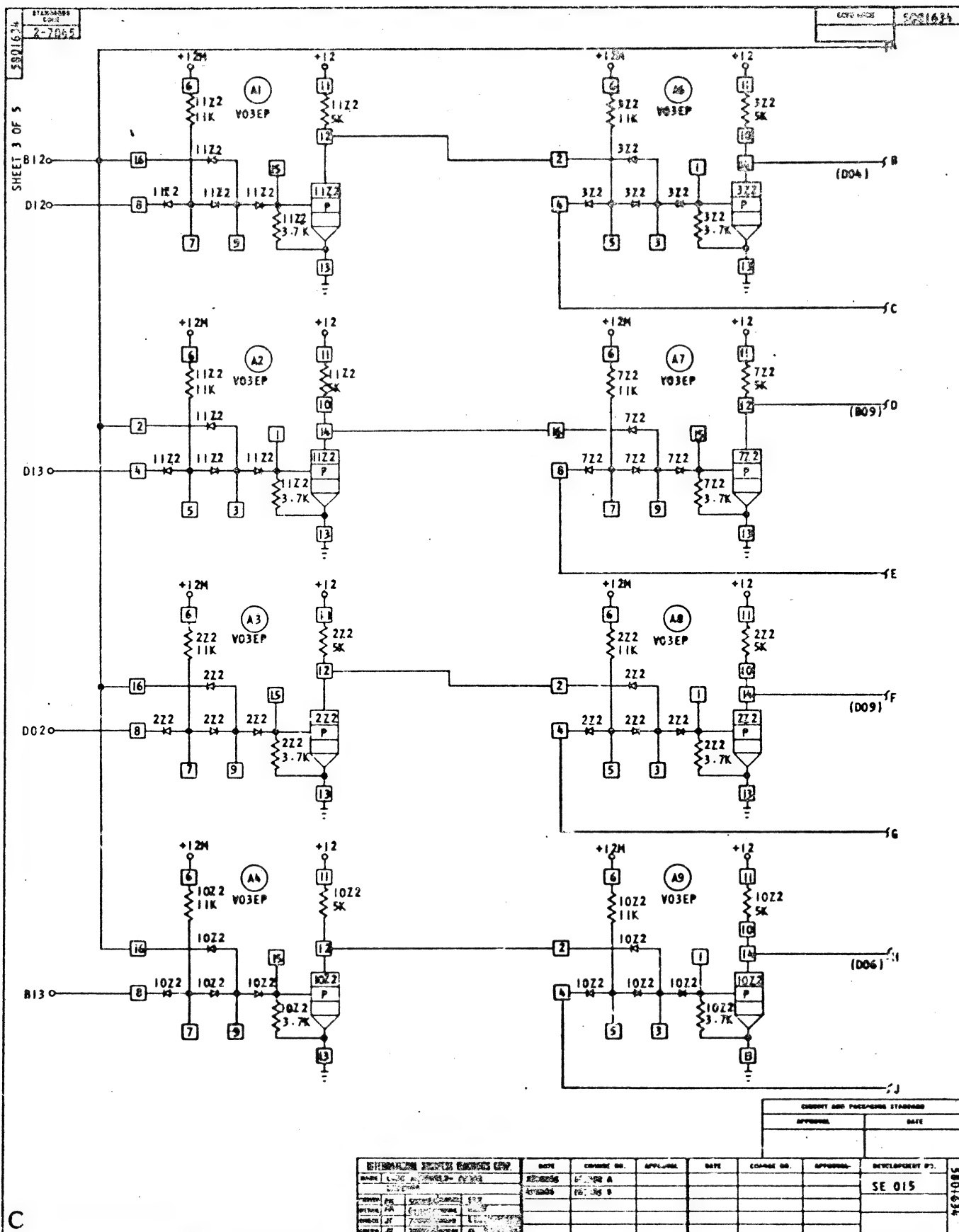
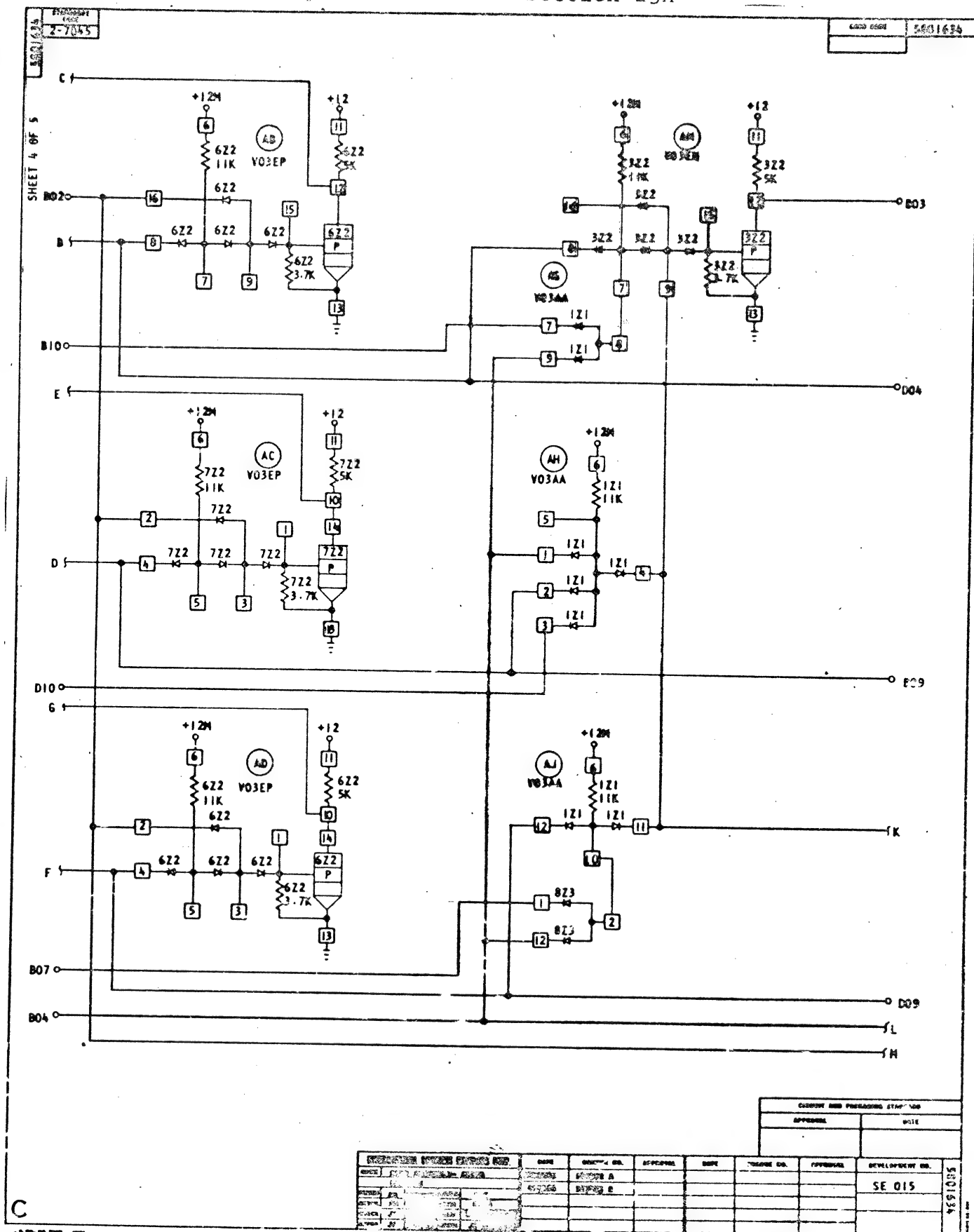
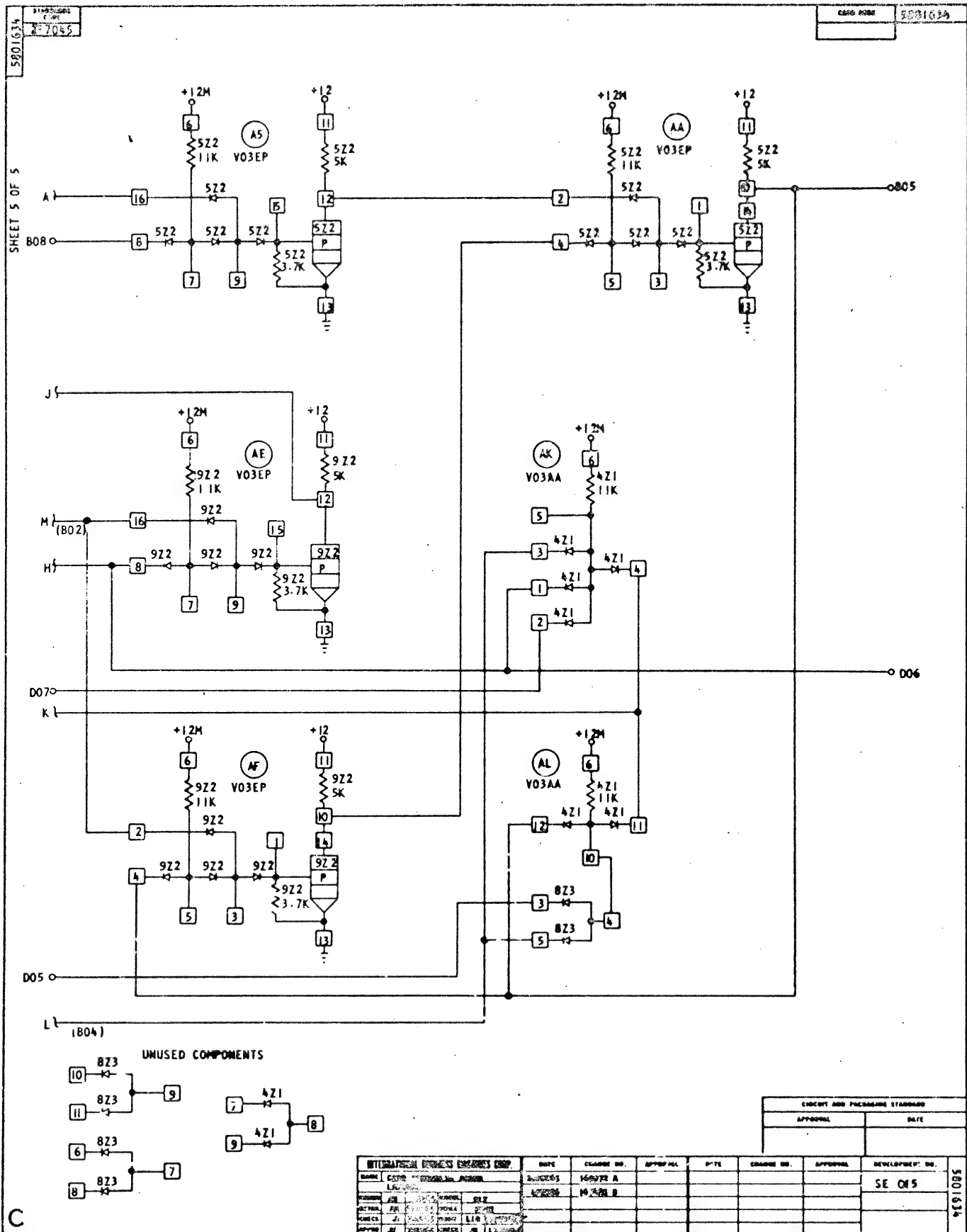



Figure #9

MANUAL CHECK FOR COMPUTER GENERATED ASSEMBLY AND RAW CARD DOCUMENTS AGAINST THE FORMAL SCHEMATIC

DESCRIPTION

The procedure will be divided in this outline into two (2) areas:

A. Checking of raw card (front and back artwork) circuitry connections against the schematic for that raw card.

B. Checking of the other pertinent information on the raw card document (This information would be notes, part numbers, E. C. , etc.).

A. The following procedure is recommended for checking the raw card printout against its associated schematic.*

The raw card printouts from the 7094 Computer are stapled together (front artwork over the back artwork). When stapling these two printouts together make sure the hole and tab locations on the front artwork printout are directly over those on the back artwork printout.

From the assembly drawing printout draw the component outline and location number (ex: 24Z3, 2Z1) on the front artwork printout.

Obtain a blueprint of the schematic sheet(s). You will check the raw card printouts against the blueprint of schematic.

Check all voltage connections on raw card printout against the schematic print. Indicate on these two documents that you have checked the voltage connection by marking a particular voltage with a colored pencil. Different voltages would have different colors to avoid confusion. Signal line connections would be another color also. When checking voltage and signal lines on the printout make sure line widths are correct (A for voltage and B for signals). C lines and diagnols can be visually checked (The errata printout will usually call out an error if these lines are shorting problems).

After the printouts have been checked for point to point connection against the schematic a final visual inspection should be made. A visual inspection should be made for possible "corner" conditions which the errata will not pick up. Corner conditions are those line conditions that have opposing junctions:

* This checking procedure is beneficial only when the schematic is drawn from the ALD and not from the multicolor.

B. After the circuitry has been checked using step A, the header information on the printout (part numbers, E. C., etc.) must be checked. The following procedure is recommended:

Use the sample list of DA header information shown on Figure #10 to check the printouts. Figure #10 titled "SLT DA OUTPUT CHECK SHEET" indicates a list of all header information which should be checked on the raw card and assembly documents printout.

After the check sheet is completed make a complete visual check of the printouts.

All errors found on the printout by improper DA input combined with the errata printout errors must be corrected, of course, and reinput through DA.

SUMMARY

To provide a manual raw card printout check against the schematic the following steps must be taken:

1. Check the raw card (front and back artwork) printouts against the schematic for that raw card.

2. Use the attached check sheet to assure that all pertinent information on the raw card and assembly documents printout is correct.

The main advantage of this manual check is that it is a process by which the raw card drawings, assembly drawing and schematic coding are all checked completely and thoroughly.

SLT DA OUTPUT CHECK SHEET

P/N ____________________
E/C ____________________
Analyzer ________________
Date ___________________

_____ 1. All printouts for correct raw card & assembly P/N (Refer to work request.)

_____ 2. Proper EC levels & dates.

_____ 3. Proper sheet numbering.

_____ 4. Raw card level.

_____ 5. Check component numbering & coding against component check sheet

_____ 6. Eng. Spec. numbers on front art printout against numbers over logic blocks on ALD. ("AG" note on assembly requires 811800 Spec. No.)

_____ 7. Check voltage pin data on DA Assembly printout against that on ALD & multicolor.

_____ 8. Check all information on Eng. Chg. data worksheets against printouts to make sure all changes were appropriately made.

_____ 9. Check wiring to be sure all signal lines are "B" lines.

_____ 10. Check wiring to be sure all voltages and ground are "A" lines.

_____ 11. Flash lines (D,E F,G,) should be in proper grids and two diagonals in length.

_____ 12. Check for illegal corner conditions on artworks.

_____ 13. If internal plane is used, check all pickup points & check bussing requirements if any. Also check I.P. P/N.

_____ 14. Notes on components should agree with the SLT Ground Rules.

_____ 15. Check contact quantity in "CE" note.

_____ 16. All 7094 errata should be corrected.

_____ 17. Check decoupling note against that on multicolor.

_____ 18. Check all notes on multicolor & printouts for compatability.

_____ 19. Check wiring under special components (i.e. Tstr, Reeds, Crystals, Pots) to see that it conforms to ground rules.

_____ 20. All check prints & check print-outs to be stamped, dated & initialed by checker.

Figure #10

SCOPE

This section defines the requirements of a combined ALD-Schematic.

This method was designed originally for all modular SLD cards. However, changes have been incorporated which allow certain SLD/SLT cards to use this method. Only SLD/SLT cards that can be documented ALD-SCHEMATIC wise within the following ground rules may use this method. All other cards must use one of the other methods.

DESCRIPTION

The ALD-SCHEMATIC is a single computer-generated document that satisfies both ALD and Schematic requirements. When it is used, an individual schematic document is not required; however, it may only be used if the circuit elements associated with each circuit flyer used on the card are contained within one component. An advantage to this method is that the ALD-SCHEMATIC is kept on a Logic Master Tape (LMT); this provides the user with a history on one tape. Also realized when using this method is a reduction in the number of card documents required to support the physical card assembly.

MAINTENANCE & RELEASE PROCEDURE

The ALD-SCHEMATIC pages for each SLT or SLD card are put on the Assembly LMT. This LMT is sent to R.P. Larnerd, Dept. 310, Endicott.

BLOCK FORMAT

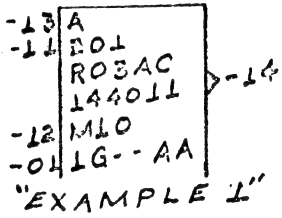
The SLT Card Logic Diagram instructions (Suffix 1) must be followed with these exceptions: (Refer to Example 1 on the following page)

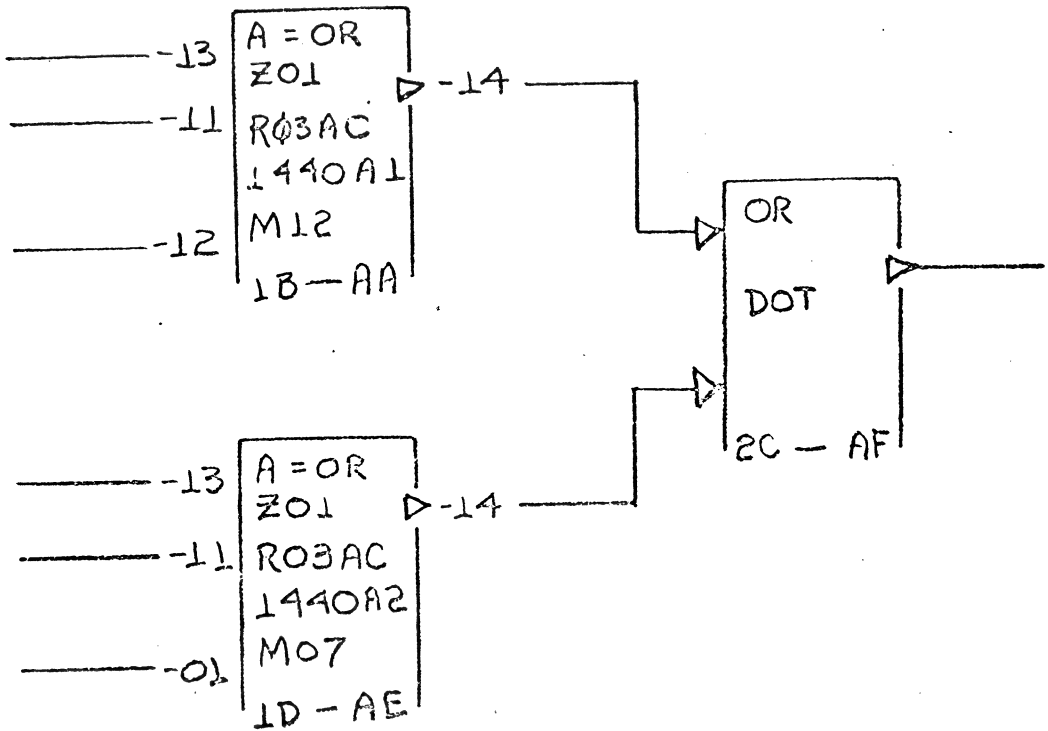
(a) Line Two - The card assembly component identification code (Z1, R1, A1, etc.) use 3 characters, i.e., Z1 = Z01.

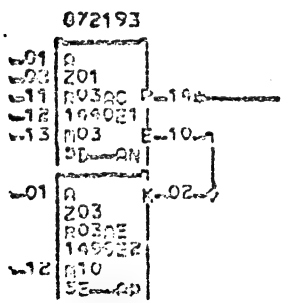
(b) Line Four - The last four digits of the component part number plus normal portion and subportions.

(c) Line Five - Component location sequence number from assembly drawing. The first alpha character is the component type code, using input format. The second character is the position sequence on the card.

(d) Block Inputs and Outputs - Show the component pins associated with each signal line. Unused input and output pins are not to be shown on these blocks (see spare block, page 5 of 13, Section 23B).

```
-13 | A         |
-11 | Z01       |
    | R03AC     |▷-14
    | 144011    |
-12 | M10       |
-01 | 1G--AA    |
 "EXAMPLE 1"
```

Dot blocks must be used when required (as in Example below).

```
-13 | A=OR   |
    | Z01    |▷-14 ──┐
-11 | RØ3AC  |       │     ┌─────────┐
    | 1440A1 |       └───▷ | OR      |
-12 | M12    |             | DOT     |▷────
    | 1B—AA  |       ┌───▷ |         |
                     │     | 2C — AF |
-13 | A=OR   |       │     └─────────┘
    | Z01    |▷-14 ──┘
-11 | R03AC  |
    | 1440A2 |
-01 | M07    |
    | 1D - AE|
```

"And" Extenders - Diode extenders are represented by a separate block.

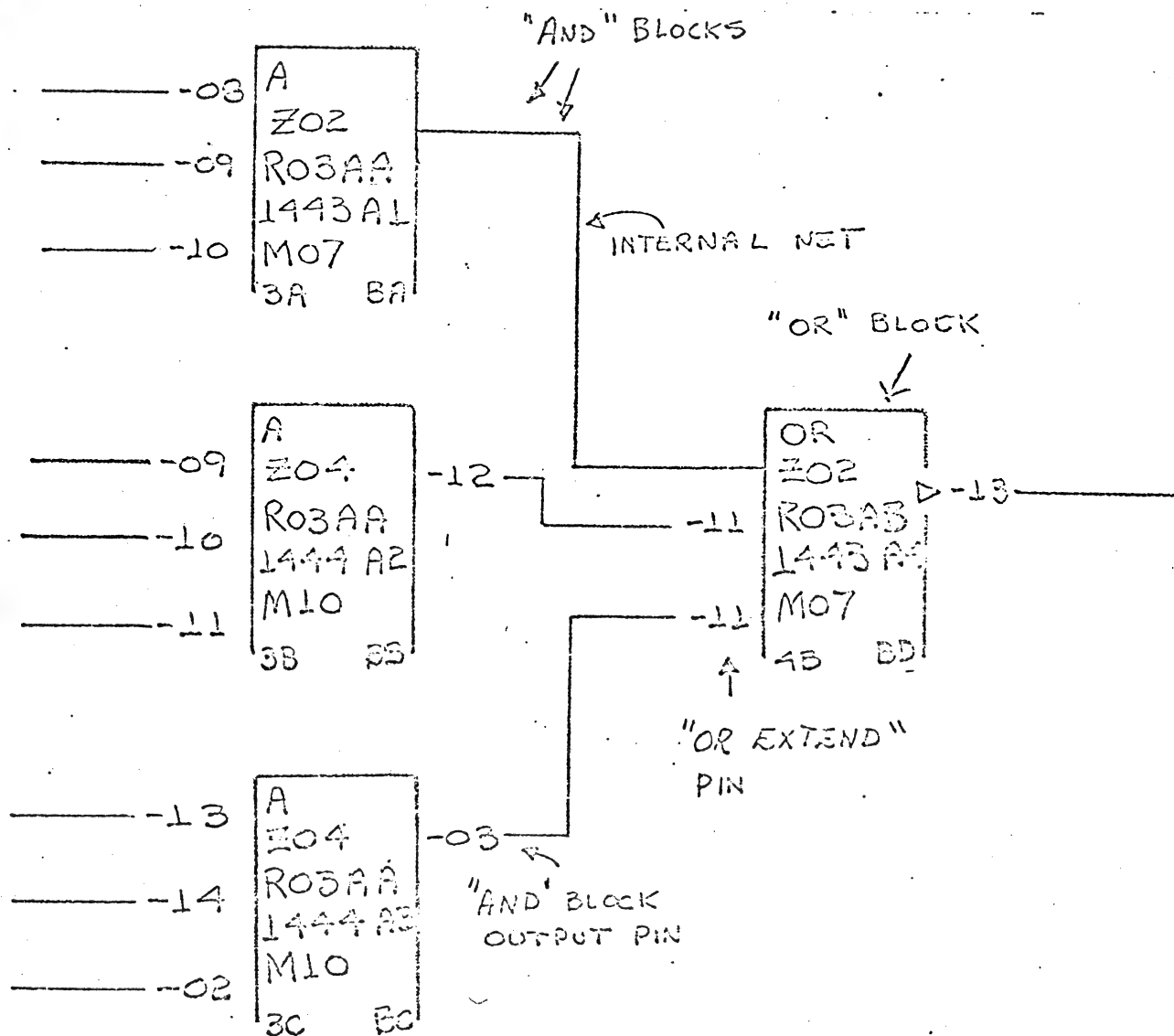
```
      072193
-01 | A       |
-02 | Z01     |
-11 | R03AC   |P-14
-12 | 144021  |
-13 | M03     |E-10─┐
    | 3D—AN   |     │
-01 | A       |K-02─┘
    | Z03     |
    | R03AE   |
    | 144022  |
-12 | M10     |
    | 3E—AP   |
```

NOTE*

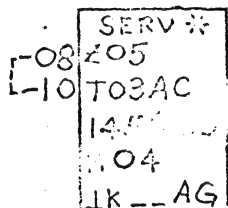
R03AE FLYER

One output - must be in pos. 2
Two outputs - must be in pos. 2 and 4
Three outputs - must be in pos. 2, 4 and 6
Four outputs - must be in pos. 2, 4, 6 and 7

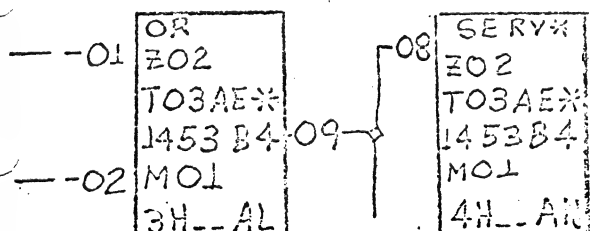
*If the note is not followed for R03AE, DA errata will result.

"OR" Extend

The "OR" extend is shown by indicating the correct pins at the output of the "AND" block and repeating the input pin to the "OR" block for each "AND" output line (see example below). Internal nets have no pins indicated. When possible, internal net connections should be the top or first input position. This will reduce the manual coding effort required for Logic Test Data.

** Extending within the same module - When it is necessary to extend within the same module, the pins dedicated with this condition should be shown in a SERV* block. The flyer ID and portion/subportion numbers are the same as the function block.

SERV*
-08 Z05
-10 T03AC
14...
M04
1K--AG

** Load resistors contained within the module performing the function should be shown in a SERV* block. With the exceptions of lines 1 and 6 the information in the function block is duplicated in the SERV* block.

OR
-01 Z02
T03AE*
1453B4 09
-02 M01
3H--AL

SERV*
-08 Z02
T03AE*
1453B4
M01
4H--AN

** An alternate method using listed blocks for representing these conditions is being investigated and will be included in the next draft if approved.

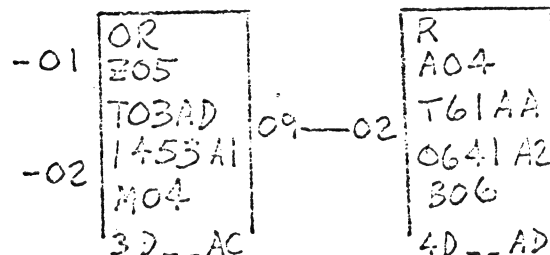
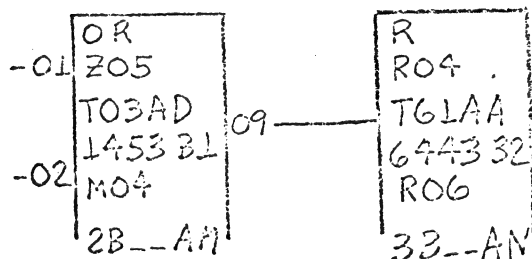
Load Resistors When the load resistor is implemented with a R/C pac or discrete component, a separate block must be drawn (see examples below). The appropriate circuit flyer block ID should be coded on line 3 and the last 4 digits of the component part number entered in the first 4 positions on line 4. All other data on the load blocks will be the same as Example 1 (page 2).

OR
-01 Z05
T03AD
1453B1 09
-02 M04
2B--AM

R
R04
T61AA
644332
R06
33--AN

OR
-01 Z05
T03AD
1453A1 09 -- 02
-02 M04
3D--AC

R
A04
T61AA
0641A2
306
4D--AD

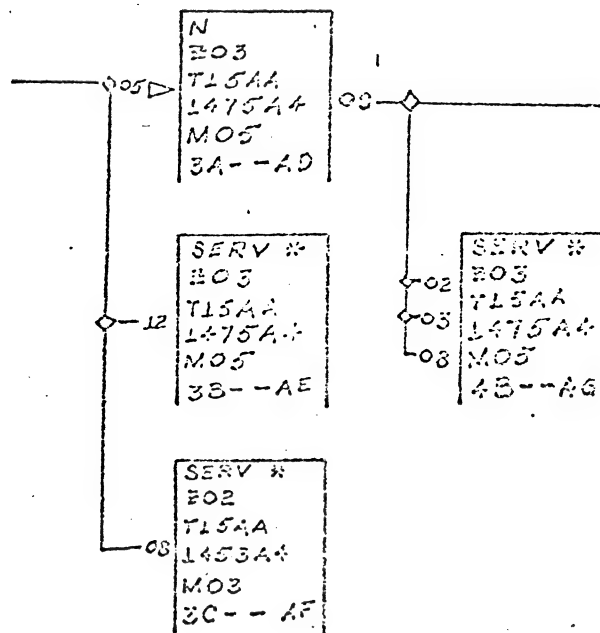
Load resistor - discrete component exam. Load resistor - R/C pac exam.

Load Resistors (continued)

Multiple loads as required in the T15AA, are shown in this example. NOTE: Lines 3 and 4 carry the flyer ID and portion subportion numbers of the function block, while the other data is as specified in example 1 (page 2).

N
B03
T15AA
1475A4
M05
3A--AD

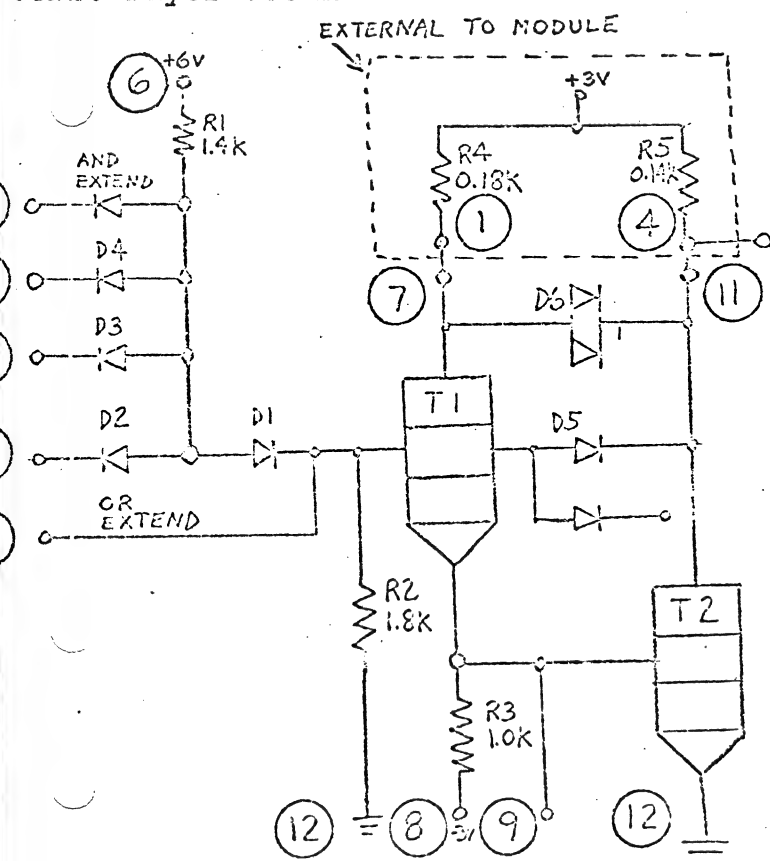
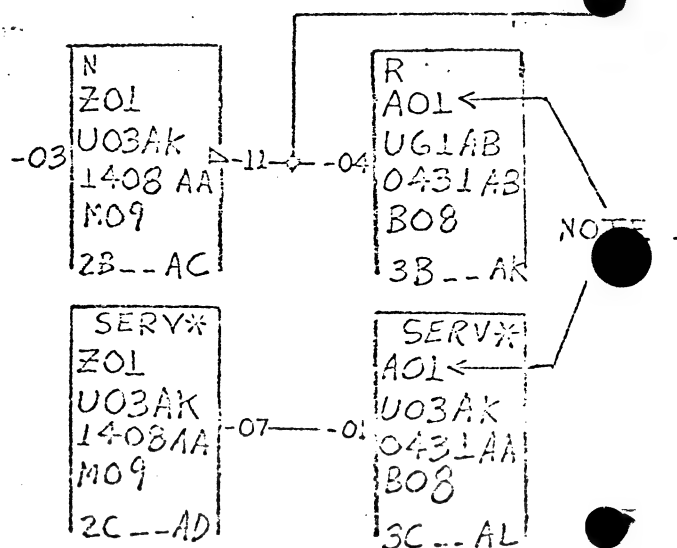
SERV *
B03
T15AA
1475A4
M05
3B--AE

SERV *
B02
T15AA
1453A4
M03
3C--AF

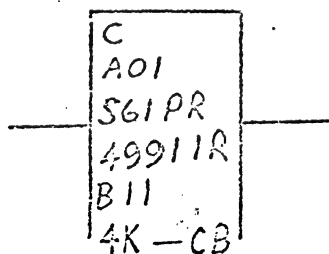
SERV *
B03
T15AA
1475A4
M05
4B--AG

Combined Circuit Flyers

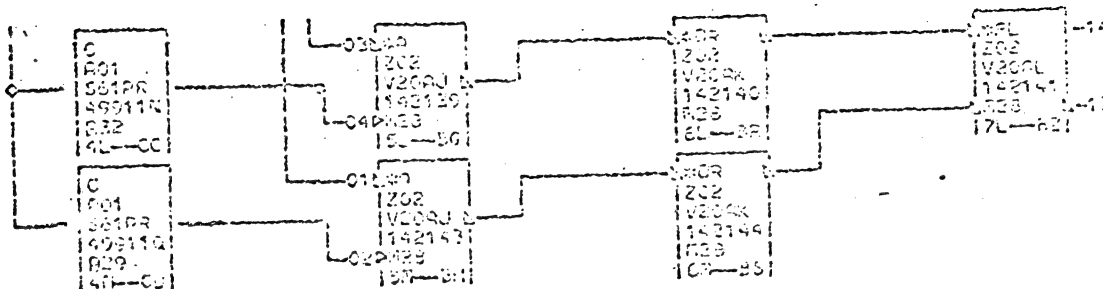
Combined Flyers must meet the ground rule of one component per flyer (as stated on page 1). In order for combined flyers to be shown, they must be represented by their unit flyer breakdown.

The following is an example of the ALD-Schematic representation of the "combined flyer V03AL*".

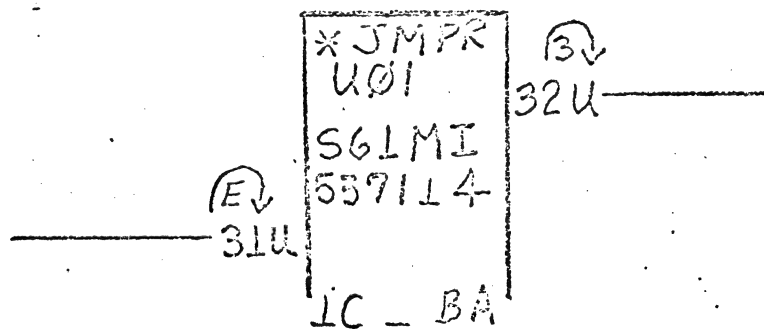
Schematic of
Comb. Flyer V03AL

SLT/ALD-Schematic Representation
of Comb. Flyer V03AL

NOTE 1: Load resistors do not necessarily have to be in the same R-pac.

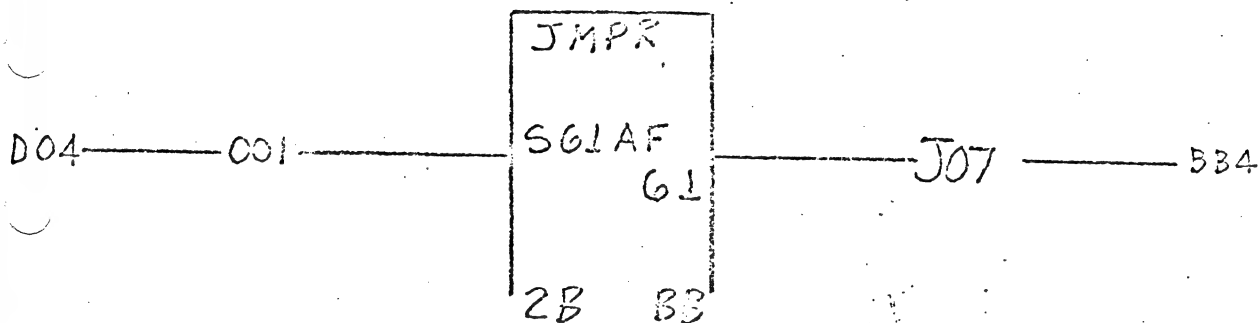
Two-Pin Modular or Discrete Component Circuits

Any two-pin modular or discrete non-polarized component circuit which is represented on the assembly drawing without pin designation must also be represented on the ALD-Schematic without pins shown (see example below). The appropriate input pin must be shown only if the component is polarized.

Integrated Circuits

Integrated circuits can be shown on the ALD-Schematic if they follow the ground rules of having one component per flyer. (See example below.)

NOTE: The Group code and unique block identifier are not shown as in the SLT-ALD (Suffix 1, Section 8).

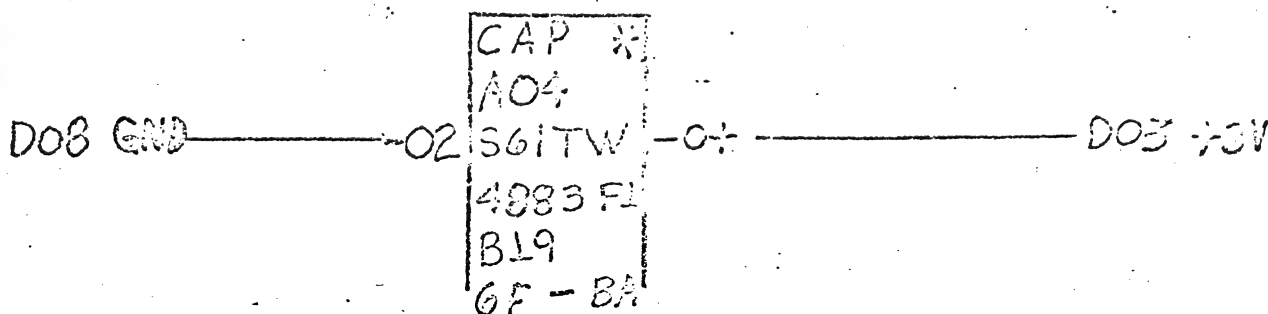
JUMPER BLOCKS

Jumper Blocks (programmed) will be shown as below:

Note: Program Cap 31U1 and 32U1 from the assembly drawing will be identified as 31U and 32U on the ALD-Schematic. (This will be input where the pin position usually is input beside the block).

Jumper Blocks, used to connect two card tabs together, will be shown as below.

Decoupling Capacitors

Decoupling capacitors are drawn as separate blocks. The block function is CAP and an asterisk is coded on the far right end Line 1. The circuit Block ID is entered in Line 3 instead of the capacitor value. The last 4 digits of the data component part number are entered in the first 4 positions of Line 4 and the assembly code in Line 5.

Decoupling is indicated by a Cap* Block, i.e.

```
                    CAP   *
                    A04
D08 GND --------02  S61TW  -04 ----------- D03 +3V
                    4883 FL
                    B19
                    6F - BA
```

Comments Section

(Contains SLT/SLD Module or 4, 6, or 8 leaded RC module Voltage Pin Assignment)

```
Line 1    Card=Size, = 2-24 = PAC========= T03
Line 2    Voltage = Pins
Line 3    +6V, B11, G11 =====+3V, D03, J03
Line 4    -3V, B06, G06 ===== GND,D08, J08
Line 5    Standard = Restricted
Line 6    *All = Voltages = Are = Bussed
Line 7    *Z1 = +06 = 03, +03 = 07, -03 = 11, 00 = 10
Line 8    *Z2 = +03 = 07, 00 = 04, 10
Line 9    *A1 = +03 = 04
Line 10   *
```

Note: 00 is used to indicate ground on module voltage pin.

Each line has MAX of 30 characters. If the number of modules used on the card causes the comments section to exceed 10 lines, additional voltage pin data can be entered on a second ALD-Schematic page.

Line 6 (above)

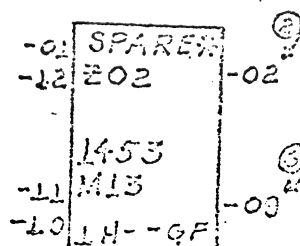
(a) When all voltages are bussed enter "All voltages are bussed".
(b) When no voltages are bussed enter "No voltage bussing".
(c) When some voltages are bussed enter "GND only bussed or +06 only bussed", etc.

Title Block - Same as in Card ALD, Suffix 1.

Unused Components

Unused component portions are indicated by blocks drawn on the ALD-Schematic. The block used for the unused component is the same as the general block with the following exceptions:

Line 1 within the block will contain the word "SPARE" followed by an asterisk. Unused component portions may be shown as described.

```
        2
-01 | SPARE* |
-12 | E02    | -02
    |        |
    | 1455   |  3
-11 | M15    | -03
-10 | 1H--GF |
```

No Block ID nor card portion/subportion code is assigned to this block.

All module pins associated with the unused component portions must be shown. If several sections of the same module are unused, they may be drawn in one block with the inputs and outputs drawn in opposite position. That is, directly across from each other on the block.

ALD-Schematic Page Numbering

ALD-Schematic pages will be numbered in order followed by the assembly drawing page (the last numbered page or pages). For example, if there are two ALD-Schematic pages and one assembly drawing page, the ALD-Schematics will be numbered, Sheet=1=of=3, Sheet=2=of=3, and the assembly drawing will be numbered Sheet=3=of=3. This information's input above block position on the ALD-Schematic in the form of "sheet=x=of=x".

SLD ALD-SCHEMATIC

IBM

SOLID LOGIC PAGE CONNECTORS

SHEET 1 OF 1

DO NOT KEYPUNCH

MACHINE *ASSEMBLY* PAGE NO. *74661* VERSION

	BLANK (20)	NET IDENTIFICATION (21–28)	LEVEL (31)	CONNECTOR (32–42)	± SL (43)	# (44)	LEVEL (51)	CONNECTOR (52–62)	± SL (63)	# (64)
1		9Ø1		J13						
2		9Ø2		J1Ø						
3		9Ø3		G1Ø						
4		9Ø4		GØ3						
5		9Ø5		GØ7						
7		9Ø6		GØ9						
8		9Ø7		JØ6						
9		9Ø8		JØ7						
10		9Ø9		BØ8						
11		91Ø		DØ9						
12		911		J12						
13		912		G12						
14		913		JØ9						
15		914		D12						
16		DC4		BØ7						
17		EC4		D1Ø						
18		ED4		D13						
19		EE4		B12						
20		EF4		D11						
21		EG4		GØ4						
22		EH4		JØ2						
23		EK4		GØ3						
24		FA2		J11						
25		FA5		G13						
26										
27										
28										
29										
30										
31										
32										

COL. 20
− INDICATES DELETE ALL CONNECTORS FOR THIS NET

COL. 43, 63
+ = ADD (USED ONLY TO INSERT CONNECTORS WITHIN EXISTING STRING)
− = DELETE
BLANK = REPLACE
# = SEQUENCE NUMBER WITHIN NET

Edge Connector Data

1. Use Form Number 620-8172
2. Fill out one or more forms for each ALD-Schematic page.
3. Data to be entered:

   (a) Machine - Assembly
   (b) Page number - from ALD-Schematic
   (c) Version - leave blank
   (d) Net Identification - for each line associated with a component pin, use psuedo net number or real net number excluding inputs from other pages. (Pack Left)
   (e) Connector - Use card I/O Tabs (B06, D11, etc.). Pack Left

4. Sample form. (See example on the following page.)

Special Notes

Note 1: The Systems logic block format must match the configuration used on the ALD-Schematic. A good example of this is the logic "And" extender. "And" extends should be shown in the same number of blocks on the systems' page as the ALD-Schematic. If this compatibility is not maintained SLDA erratta will be produced on Systems PCS runs.

Note 2: ASLT Autoup Program must be used to transfer the wiring rules of the SLT/SLD ALD-Schematic from the LMT to the CMT. Otherwise DA erratta will result.

ENTR BLOCKS

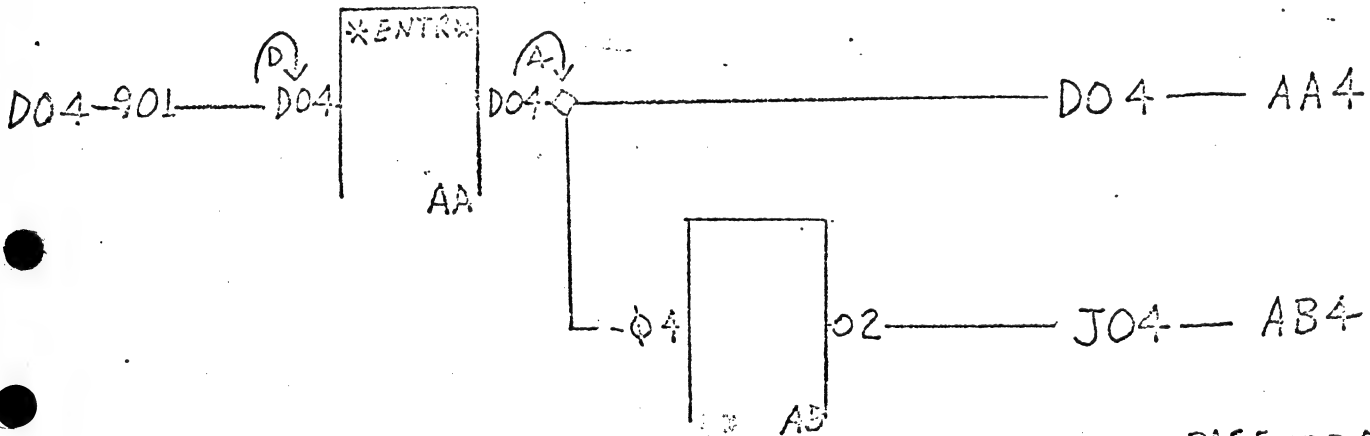
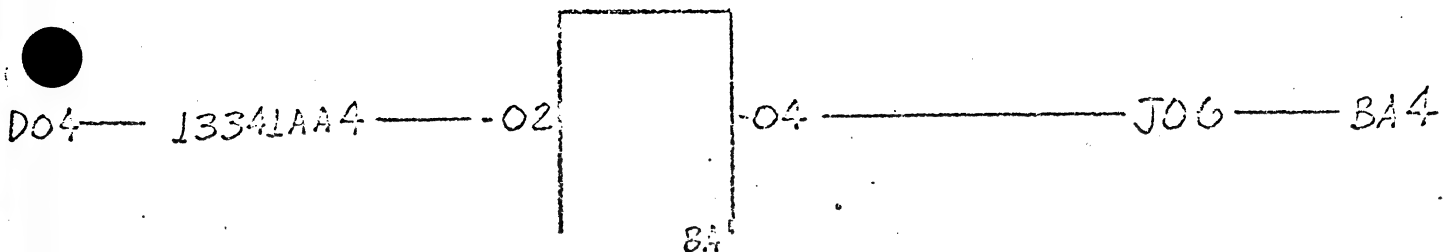
When using ENTR Blocks show in the following manner:

D04-901 —— D04 [*ENTR* AA] D04 —— D04 —— AA4

-04 [AB] 02 —— J04 —— AB4

PAGE 13341

PAGE 13342

D04 —— 13341AA4 —— -02 [BA] -04 —— J06 —— BA4

Using the above example, code the logic page connector sheet for an ENTR block as follows:

The page where D04 appears as an output will be the only page which will call out the card tab as a logic connector (see example below). Card tab D04 must not be called out as a logic connector on page 2 of the Logic Connector Sheet.

IBM Solid Logic Page Connectors

SHEET 1 OF 2

MACHINE ASSEMBLY PAGE NO. 13341 VERSION

BLANK	NET IDENTIFICATION	LEVEL	CONNECTOR	=BL	#	LEVEL	CONNECTOR	=BL	#
20	23 24 25 26 27 28	31	32 33 34 35 36 37 38 39 40 41 42	43	44	51	52 53 54 55 56 57 58 59 60 61 62	63	64
	AA4		D04						

SLD ALD-SCHEMATIC

SLD ALD-SCHEMATIC

SCOPE

This section defines the requirements of an SLT Manual Block Schematic used in the release of an SLT Card.

DESCRIPTION

The Manual Block Schematic is a hand drawn document that may be used in combination with a full line schematic when a portion of the Circuit Flyers on the card ALD (flyer) meet the following criteria:

1) The circuit elements associated with each circuit Flyer to be represented by a single block are contained within one component.

2) The circuit Flyers satisfying Item (1) must appear more than once on the Card ALD in order to insure that the total number of schematic pages is reduced as compared with the full line schematic.

This procedure does not replace the existing Schematic Ground Rules (Section 23A), but does provide an alternate procedure which may be used if the conditions stated above are satisfied.

DESCRIPTION (CONTINUED)

The Example on previous page contains the following items:

1) Circuit Flyer Inputs - Each input line on the card ALD is indicated and the associated module pin placed on the left side of the block. The order shown should match the line position order on the Card ALD. Unused input pins are shown only if they can be interchanged with existing pins and are drawn below the wired ones.

2) Voltage Pins - (Component pin to card connections that are assigned to voltages). Positive Voltage Pins are indicated on top of each block and negative voltages plus ground on the bottom. If the number of voltage pins used causes the spacing to become crowded, the width of the block may be increased.

3) Output Pins - Each output line on the Card ALD is shown and the associated module pin placed on the right side of the block. If the module involved has a load resistor but the circuit function does not require that it be wired, the correct module pin should still be shown, i.e.: In the example block, if the circuit were T03AA, pin 8 would still be shown but not connected to pin 9.

4) Internal Block Data - (for convenience called lines 1, 2, 3, 4, 5)

   Line 1 - Circuit Function from Card ALD and Circuit Flyers

   Line 2 - Card Assembly Component Identification Code from Assembly Drawing.

   Line 3 - Circuit Flyer Block ID.

   Line 4 - Last 4 digits of the component part number in the first 4 positions of Line 4. The Circuit Flyer Portion, Sub-Portion code must agree with Card ALD block equivalent.

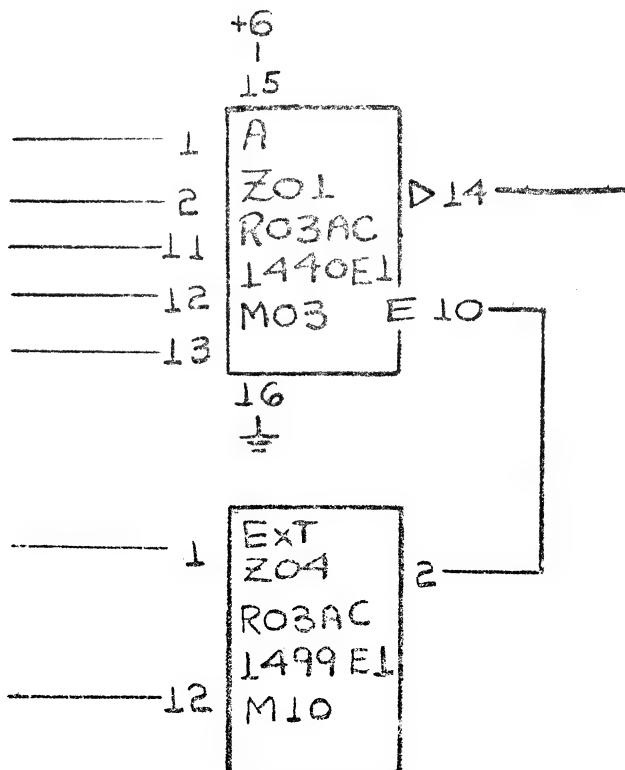
   Line 5 - Component Position sequence number from Assembly Drawing.

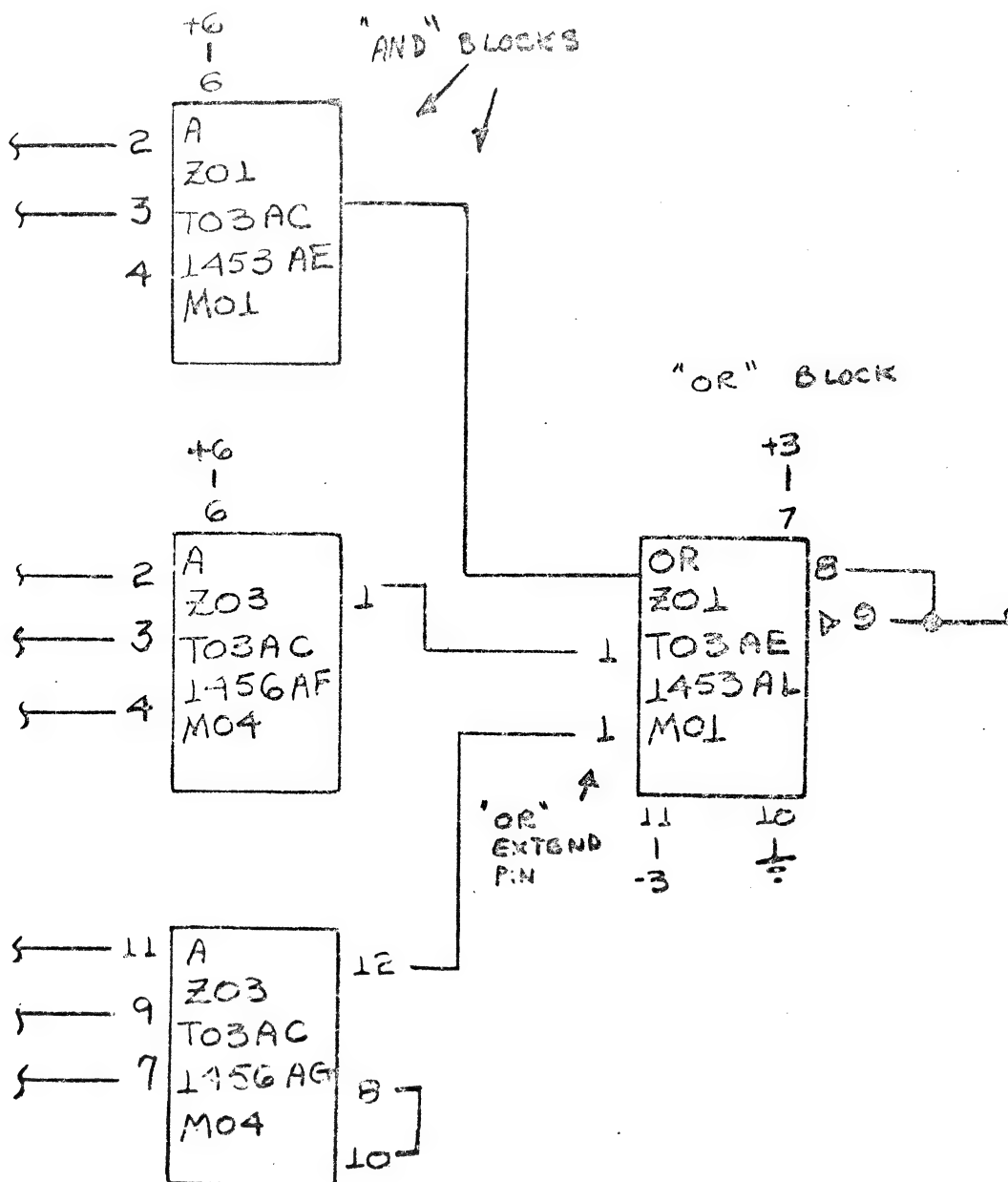
AND Extender Blocks

Diode extenders are indicated by a separate block. The function (Line 1) is indicated as EXT and the extended Circuit Flyer's Block ID is used (Line 3). The Portion, Sub-Portion code (Line 4) is also identical to that of the extended block. Module and pin data follows the typical manual block format.

EXTENDERS (CONTINUED)

+6
15
1 | A
2 | Z01 | ▷14
11 | R03AC
12 | 1440E1
13 | M03 | E 10
16

1 | EXT | 2
Z04
R03AC
1499 E1
12 | M10

The "OR" Extend is shown by indicating the correct pins at the output of the "AND" blocks and repeating the input pin to the "OR" block for each "OR" extend line.

EXTENDERS (CONTINUED)

Load resistors other than those contained within SLT Modules are drawn in conventional schematic form.

Input or output wedging to indicate signal inversion must be indicated and identical to the card ALD.

Circuitry not conforming to these rules must be drawn in conventional schematic form.

SLT Manual Block Schematic

SAMPLE

SHEET 3 OF 3

CIRCUIT CARD DESIGN AUTOMATION (CCDA)

CCDA is a system of 1401 and 7090/7094 programs designed to provide a consistant interface from SDD to SMD. This interface is the Engineering Description Tape (EDT). The digitized data on the EDT is a complete description of the circuit card assembly (except schematic) which is computer processed by SMD to establish numeric controls for the manufacturing process.

The CCDA system uses the following tape files:

a. Component Library Tape (CLT) - contains the physical and electrical description of all components that can be used on circuit cards. This tape is the source for all component data required by the programs. Two programs are available which provide listings of the electrical and physical data.

b. Circuit Flyer Tape (CFT) - a description of the flyer grid data is maintained for use in the Phase I with LR 31 and Phase II CCDA programs.

c. Card History Tape (CHT) - all locations which have operational CCDA systems maintain the latest level computerized circuit card designs on their CHT. The CHT is used as the source for card data when processing E.C.'s or regenerating EDT's.

d. Logic Master Tape (LMT) - The LMT contains the latest level logic diagrams of all cards. It is used in the CCDA system for generating LR 31, automatically packaging cards, and placing the Automated Logic Diagram (ALD) on the EDT.

Phase I -

This mode requires a manual layout of the card assembly. The layout data is then transcribed, keypunched, and processed thru the 1401 programs which do the following:

a. Check formats and some input.

b. Select component data from the CLT.

c. Organize data and prepare an input tape for the 7090/7094.

The 7090/7094 programs:

a. Check line and land spacing.

b. Check for correct transcription of nets.

c. Establish hole sizes.

CIRCUIT CARD DESIGN AUTOMATION (CCDA) (CONTINUED)

d. Generate checking documents and errata.

e. Produce an EDT.

Phase I with Logic Record 31 -

This is a mode of operation which uses additional programs and manual input to add a correlation of the logical and physical data (LR 31) to the EDT. These programs also provide checking between the layout, circuit flyers, and ALD.

Phase II -

These programs provide automatic selection and placement of components plus generation of the wire routing. Effectiveness of this routing program is 70 to 100 per cent. LR 31 is also generated automatically.

CIRCUIT CARD RELEASE PROCESSING (CCRP)

All EDT's are sent to Endicott, SMD, Systems Control Dept. 739 for processing through the CCRP system. This system produces all of the Engineering release drawings (except schematic), bills of material, and numerical control data essential to manufacture tested card assemblies. The release drawings are printed on a special printer and sent to SDD, Dept. 146 for preparation to release to the corporation. A history tape file is maintained for all EDTs processed and released. However, the assembly and ALD drawing images are not retained.

SCOPE

In order to describe circuit card information to the CCDA computer system it must be put into a digitizable form. The following write-up presents the rules required to indicate wires, lands, holes, and components in the digitizable form. Presently, two formats are available. The Combined Format shows the front and back artwork and component data on one grid sheet using different colors for each. The Separate Format separates the front and back artwork and component information on to three separate grid sheets.

Figure 1 shows an example of the Combined Format distorted grid form used for all standard hole location cards. Random hole location cards use the Separate Format grid form shown in Figure 2 .

GRID FORMS

General -

Two size forms are available in the Combined Format and one size in the Separate Format. The smaller Combined Format form is used for all card sizes up to 2-24 and the larger form is used for 2-36 cards. The smaller card sizes are indicated on the forms by drawing a heavy line down X83 for one wide cards and across Y67 for one high cards.

The SLT card grids are indicated on the forms by the numbered spaces. The alpha-numeric code at the standard hole locations is used for transcription purposes. The periphial data blocks are provided to indicate applicable records and header information for the card. These blocks are similar to the output documents as an aid to checking.

For information concerning the availability of these forms, contact Department 146.

Combined Distorted Grid Form

The combined distorted grid form is used when:

a. The front and back artwork and components are desired on one document.
b. Only standard hole locations are used.
c. The San Jose digitizer will be used to transcribe the card.

When only the standard hole locations are used, only two useable grids or channels for routing wires lie between adjacent standard hole locations.

SEPARATE GRID FORM

Figure 2

GRID FORMS (CONTINUED)

This rule has permitted these grid spaces to be expanded and the form to remain 4x size. The expanded grid spaces provide enough room for front and back artwork lines routed on the same grid to be indicated clearly. The only indications for the grids ending in 2, 4, 7, 9, which are squeezed out and required only for some 45° lines, is the form lines.

Color Codes -

Suggested color codes and line structure are as follows:

Front artwork	-	Solid Red or Orange
Back artwork	-	Dashed reproducible Blue
Components	-	Solid Green

Separate Grid Form -

The separate grid form is used when:

a. Separation of the front and back artwork and components is desired.
b. Random hole locations are used.

All SLT grids are indicated on this form by the numbered spaces.

ARTWORK LINES

Artwork lines are indicated on the grid forms by drawing a straight line within the form lines between the desired grid coordinates.

The following line widths are indicated on the grid by placing the appropriate code in the same color where the line, leaves and enters a land, tab, or changes size. Codes for "B" lines are understood and do not need to be shown.

Code	
A	.031 Offset .0125 up & right
B	.013
C	.013 Offset .0125 up & right
D	.031 Corner line upper left
E	.031 Corner line upper right
F	.031 Corner line lower right
G	.031 Corner line lower left

Artwork lines are drawn by the PCG using an octagonal reticle the size of the line width. The PCG starts and stops at the beginning and end of each line segment with the exception of D, E, F, and G lines which are flashed at the appropriate "x" and "y" grid coordinate calculated from the endpoints of the line segment given. If these lines are not drawn exactly as shown on the Line Placement Chart, the PCG will draw them in error.

"A" AND "C" LINES

"A" Lines Uses -

"A" lines are primarily used for routing voltage lines. Since they are .031 wide only one "A" line can be placed between standard hole locations.

"C" Lines Uses -

"C" lines were designed for, and should only be used for, routing a .013 line between "L" lands on standard hole locations.

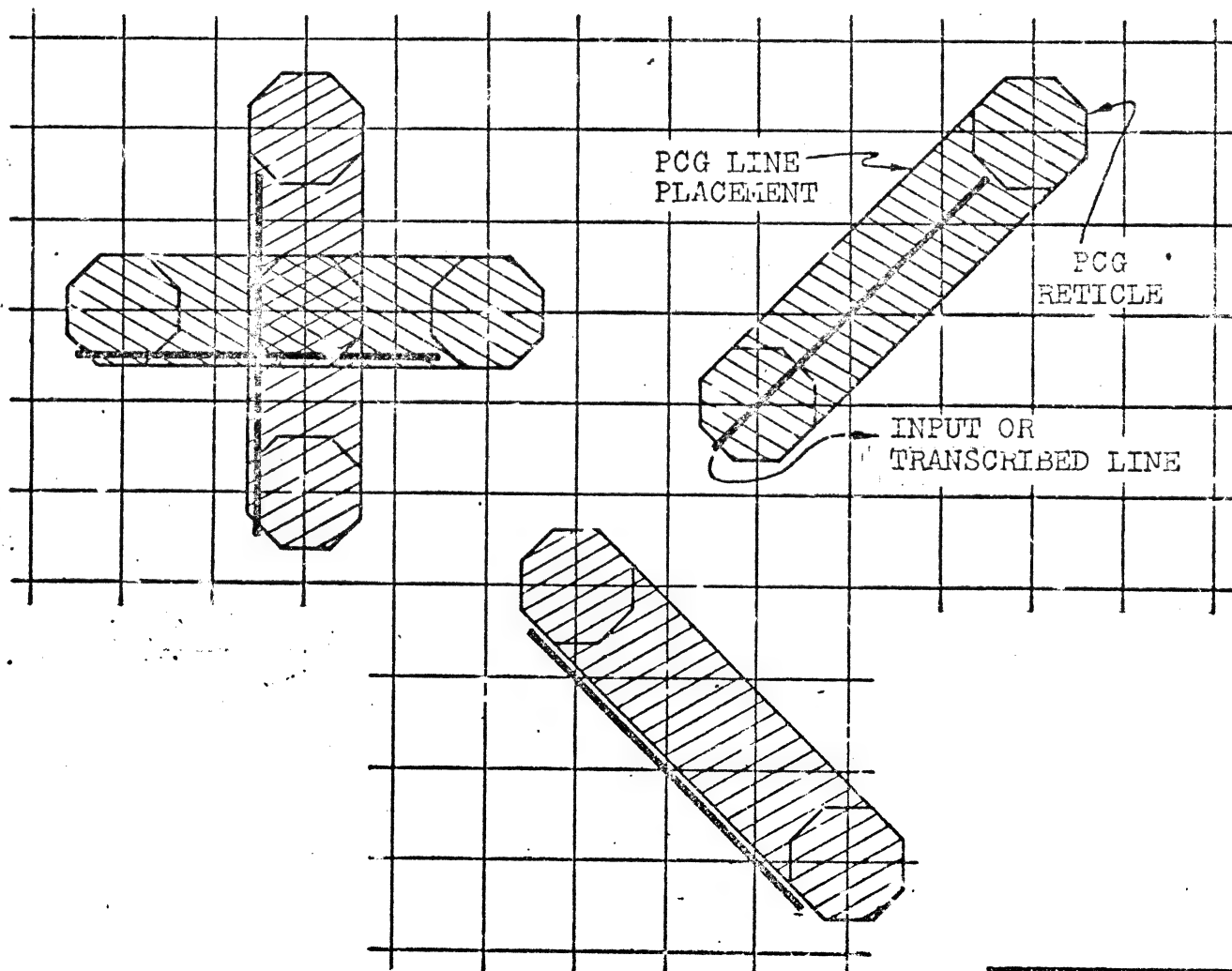
"A" and "C" Line Placement -

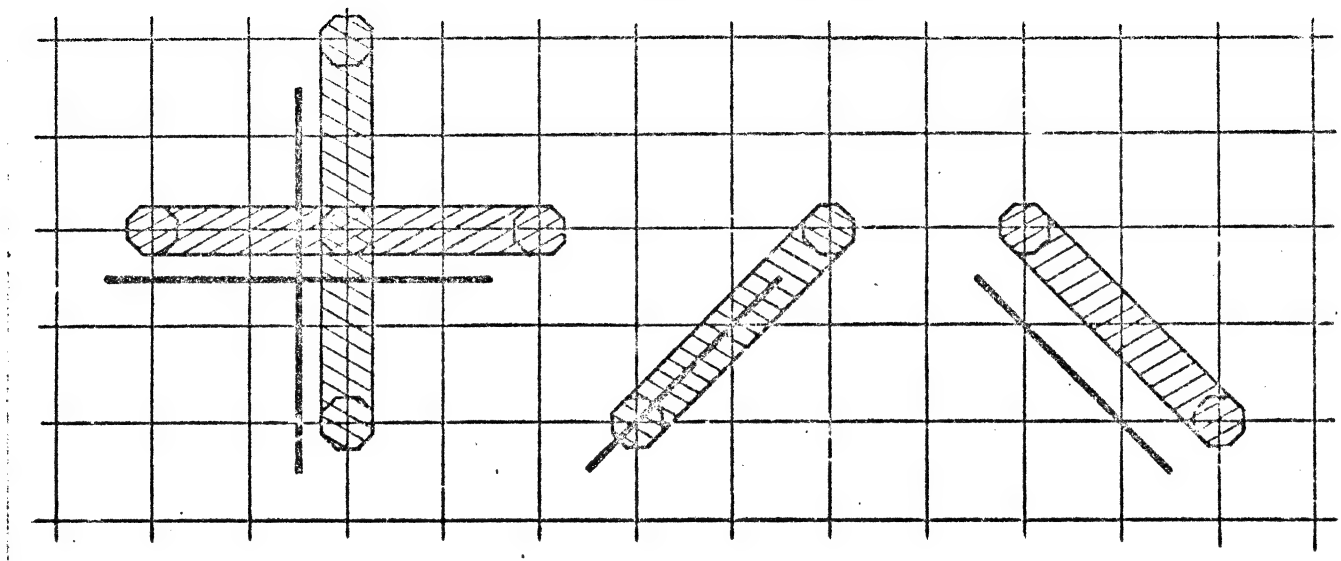
Since the reticles for "A" and "C" lines are offset .0125 to the right and up from the grid locations that they are called out for they can only be drawn in the left or lower channel, or on grids ending in 0 and 5, between standard hole locations; except Y065 on one high cards, Y125 on two high cards, and Y185 on three high cards. Refer to the following illustrations.

"A" LINE PLACEMENT

PCG LINE PLACEMENT

PCG RETICLE

INPUT OR TRANSCRIBED LINE

"A" AND "C" LINE PLACEMENT (CONTINUED)

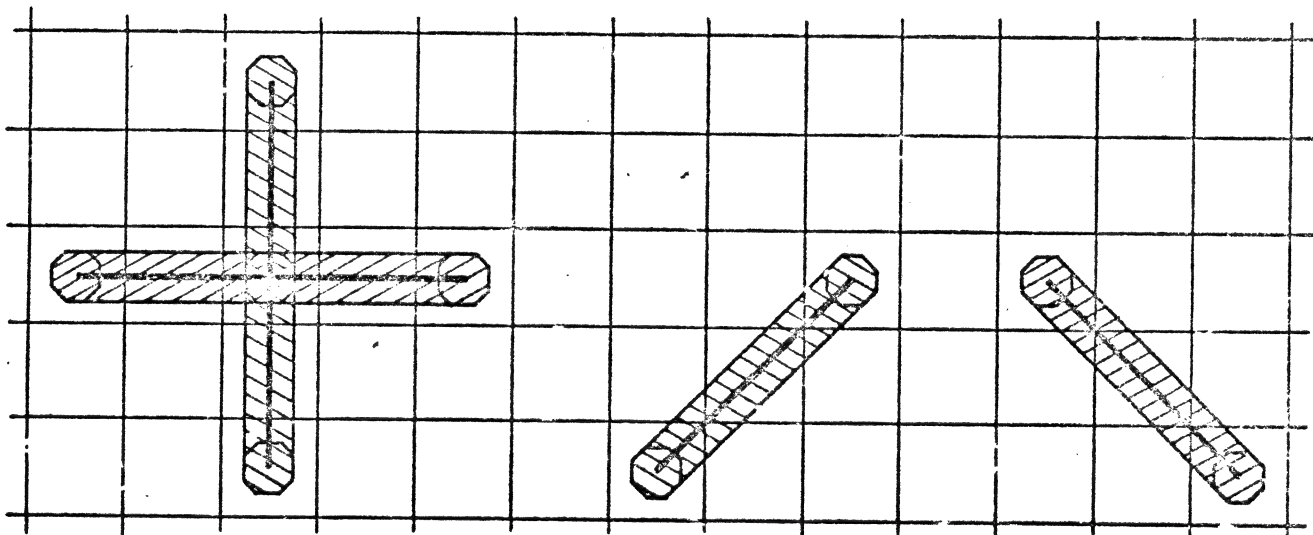
"C" LINE PLACEMENT

"B" LINES

"B" Line Uses -

"B" lines are primarily used for routing signal lines.

"B" Line Placement -

Two "B" lines can be routed between two adjacent lands on standard hole location cards or on all grids ending in 0, 1, 5 and 6 except Y066 on 1 Hi cards, Y126 on 2 Hi cards, and Y186 on 3 Hi cards. Refer to the following illustrations.

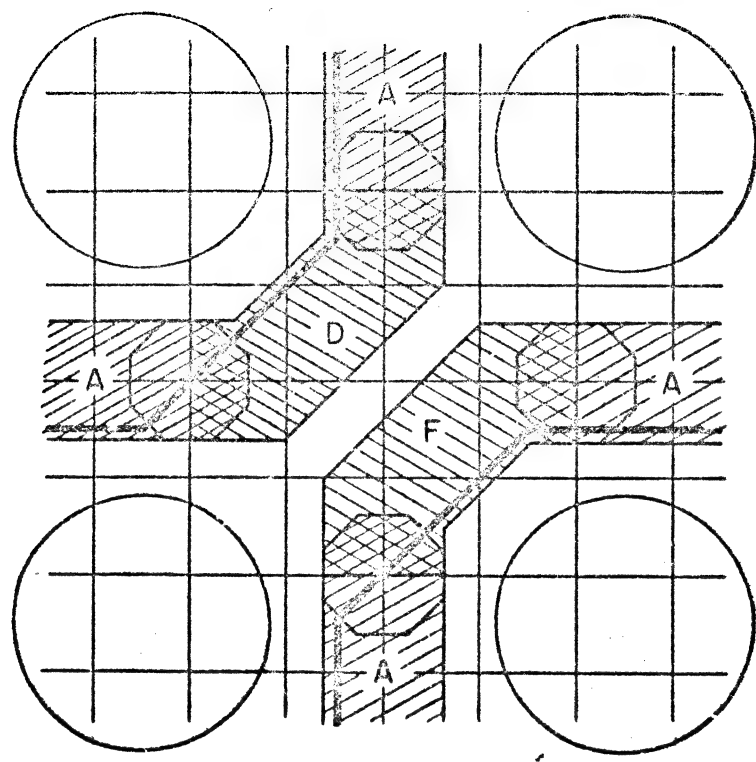
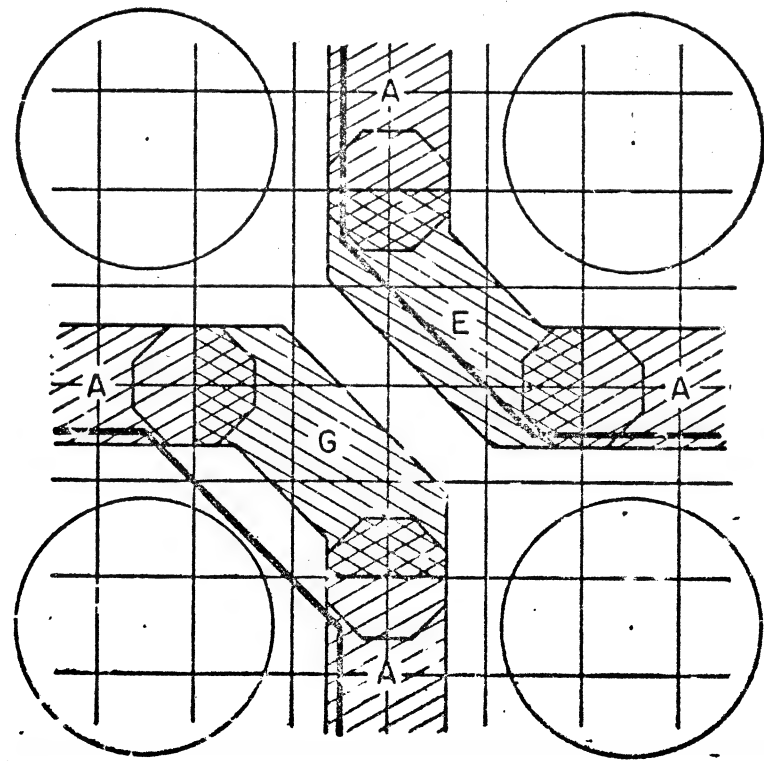
"B" LINE PLACEMENT

D, E, F, AND G LINES

D, E, F, and G Line Uses -

These lines were designed so that two .031 lines could be routed through the area between or adjacent to four standard land locations.

D, E, F, and G Line Placement -

These lines must be positioned exactly as indicated in the examples and on the line placement chart relative to the end points of the "A" line or else they will be positioned incorrectly by the PCG.

"D" & "F" LINE PLACEMENT

"E" & "G" LINE PLACEMENT

LINE ROUTING RULES

Suggested Routing Methods -

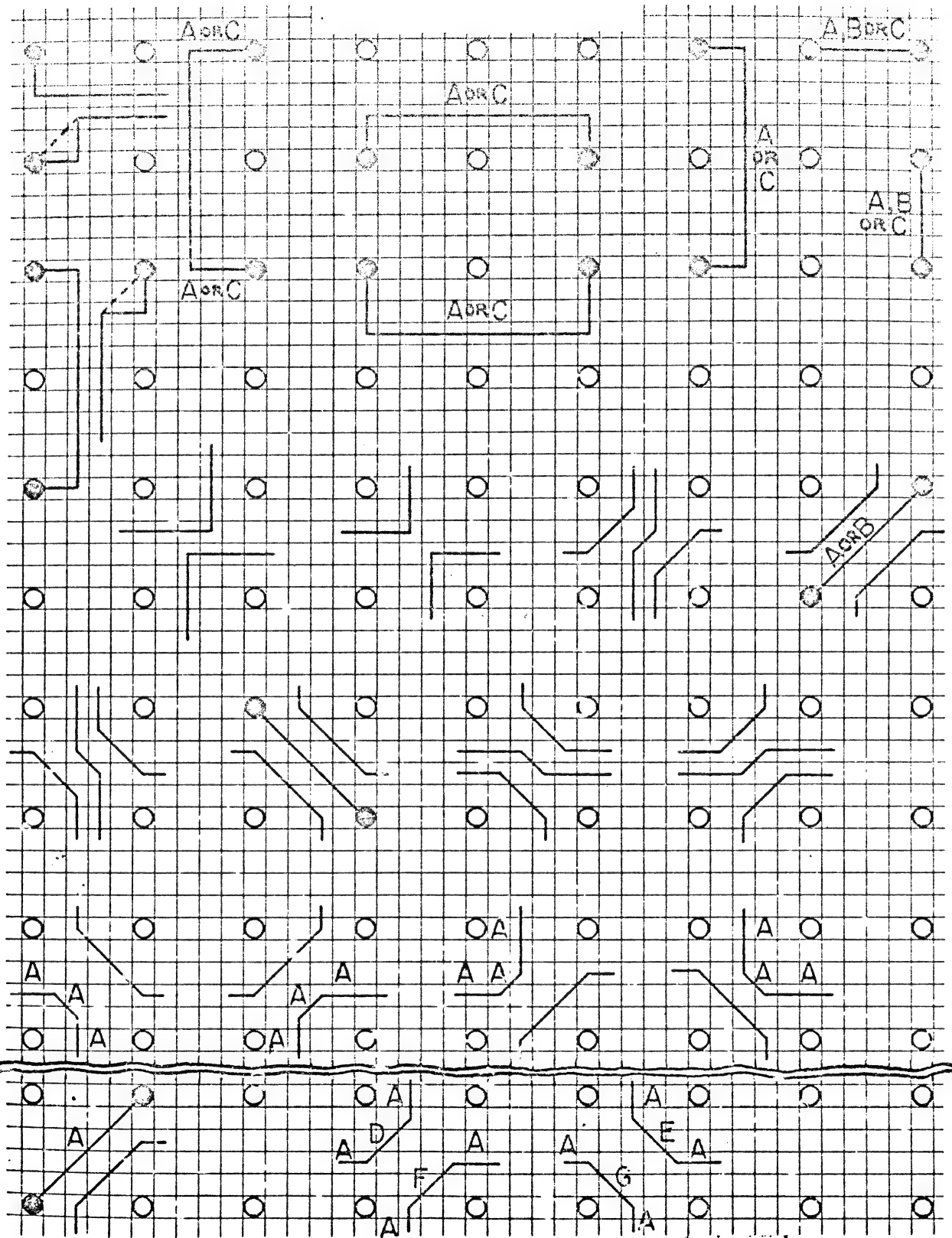
1. Opposing junctions must be avoided where possible.

2. Avoid the use of 45° lines except as follows:

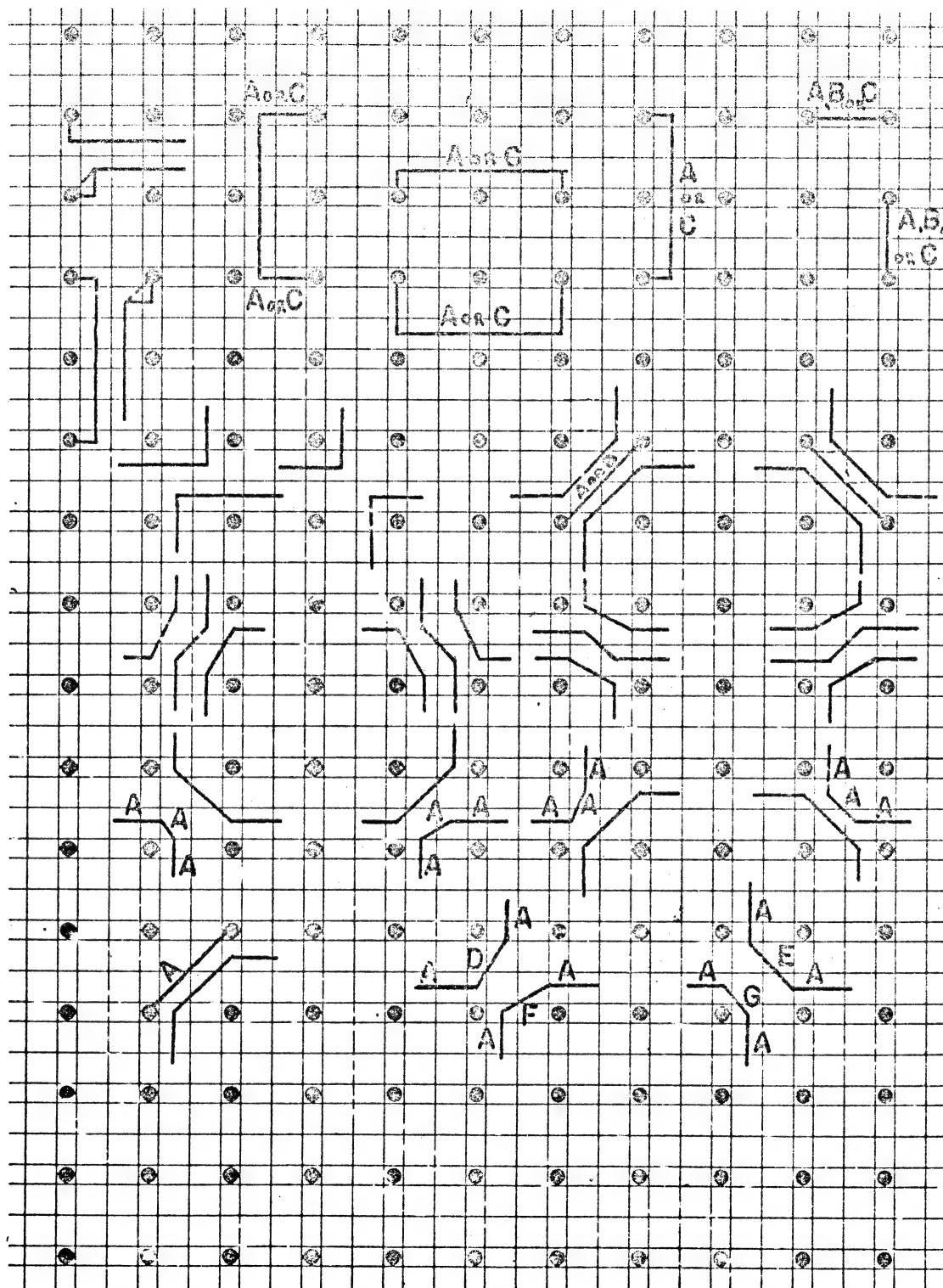
   a. Between diagonal lands
   b. In the card notch area
   c. If necessary because of packaging density

3. Different size lines should only be connected together at lands. If a requirement exists to connect different size lines together elsewhere, care must be taken to insure that a good connection is made. Refer to artwork line section for correct PCG placement.

4. The "B" line routed on Y021 in the center notch area shown in the following figure is permitted only when no other wire routing is possible.

LINE PLACEMENT CHART FOR STANDARD HOLE
LOCATION CARDS USING SEPARATE GRID

A OR C
A, B OR C
A OR C
A OR C
A, B OR C
A OR C
A OR C
A OR B
A
D
E
F
G

All lines are "B" unless otherwise noted.
All lands are "J".
Dotted lines indicate alternate routing.

LINE PLACEMENT FOR STANDARD HOLE
LOCATION CARDS ON COMBINED GRID

All lines are "B" unless otherwise noted.
All lands are "J".
Dotted lines indicate alternate routing.

ACCEPTABLE LINE PLACEMENT IN CARD EDGE AND CARD NOTCH AREAS

A or C

A or C

CENTER NOTCH

G

G

B

B

J
13

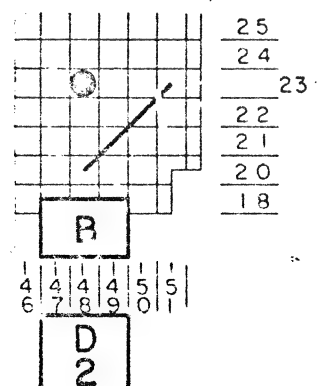
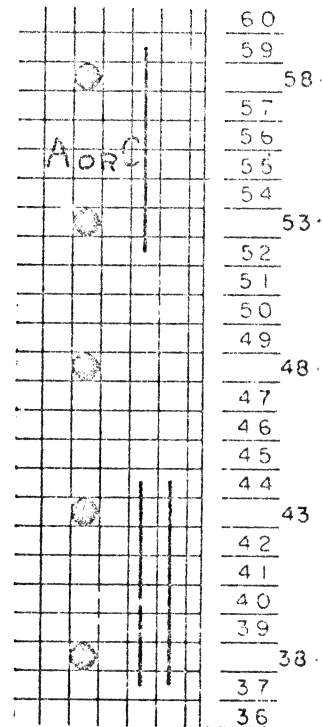
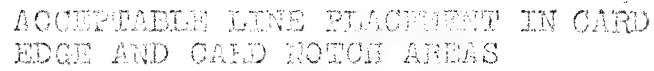
J
2

D
13

D
2

All lines are "B" unless otherwise noted.
All lands are "J".

MINIMUM ALLOWABLE LINE-LAND SPACING

All lines are B unless otherwise noted.
All dots represent J or K size lands unless otherwise noted.

12/8/6[illegible]

LANDS AND HOLES

Standard Lands and Holes -

Lands and Holes are indicated on the grid forms by dots. Their size is generated automatically by the programmed ground rules, from component lead information in the component library, and by transcribing the appropriate code at the end or beginning of a line segment where a land is desired. All via or non-component lead holes will be "J" unless overridden. Holes and land sizes can be overridden by filling out "P" data cards.

On standard hole location cards, whenever a line is drawn through or to a standard hole location, the location must be colored in. This indicates to the transcriber that a land is required at that location.

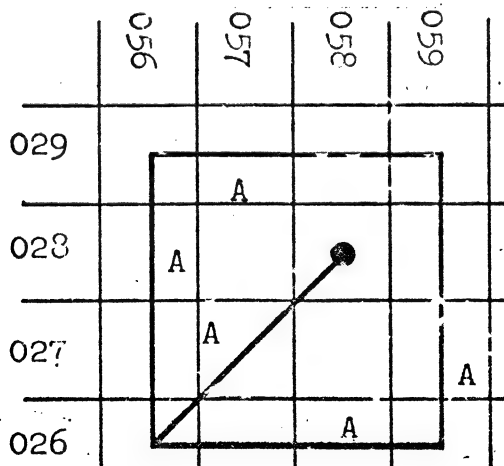
Special Land Sizes

Special Land Size Uses -

Land sizes other than J, K, L, or M or monolithic pads must be made by "A" lines. All segments must be connected together and to the hole they surround so that the CCRP programs can build the correct net information for use by the Shorts and Continuity tester. If the transcription is done correctly, no errata will be produced by the CCDA programs.

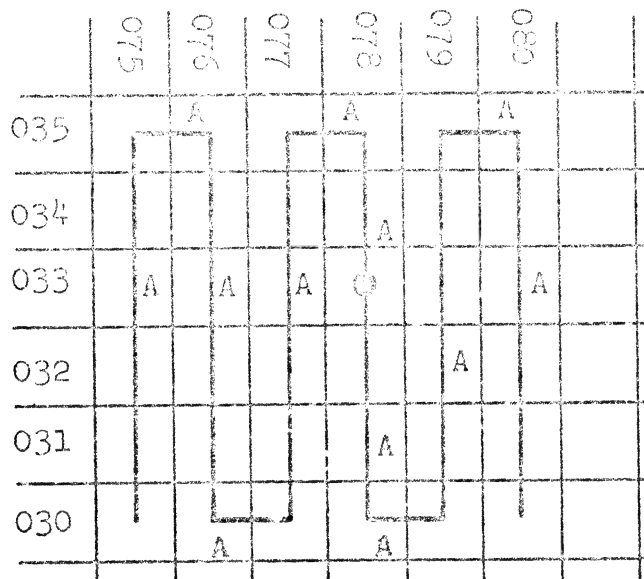
Special Land Location -

To space the finished land evenly about its hole the outside artwork lines used to draw the land must be extended one more grid below and to the left of the hole than they are above and to the right. The center will be filled in by the standard land associated with the hole.

056
057
058
059
029
028
027
026
A
A
A
A
A

LANDS AND HOLES (CONTINUED)

Other special lands should be drawn as follows:

075 076 077 078 079 080

035
034
033
032
031
030

Special Land Size -

The following formula can be used to figure out the land dimensions:

"X" or "Y" Land Dimension = .028 + .025 (High order "X" or "Y" coordinate - Low order "X" or "Y" coordinate)

Using this formula the above land size is:

X = .028 + .025 (080-075)
X = .028 + .025 (5)
X = .028 + .125
X = .153

Y = .028 + .025 (035-030)
Y = .028 + .025 (5)
Y = .028 + .125
Y = .153

COMPONENTS

Components are indicated on the grid forms by connecting their lead insertion holes, which are represented by a dot, together with a straight line. Single leaded components such as program caps are indicated by a dot. Leadless components such as heatsinks are indicated by a straight line.

COMPONENTS (CONTINUED)

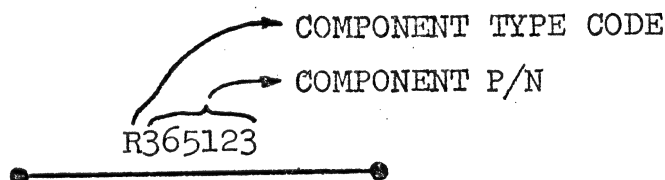
The longest dimension of a heatsink is the length in the component library. The length is the dimension that must be indicated on the grid form by the straight line. The center of the straight line should fall as close as possible to the center of the component it is used with. The assembly drawing program AUTBOM draws the heatsink outline about the center of the straight line; therefore, the length of the line is not critical but is usually drawn as long as the length of the heatsink.

A few examples of some component types are shown below. From these examples you should be able to determine the representation for all other components.

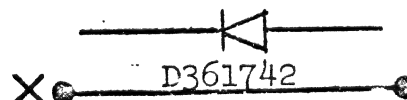
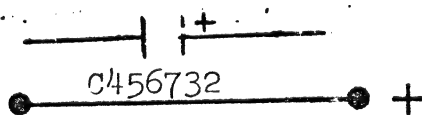
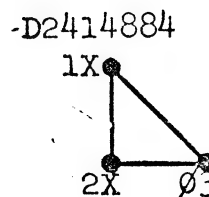
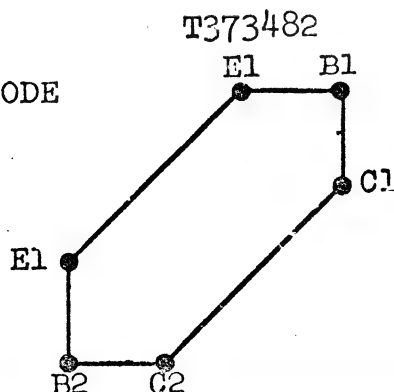
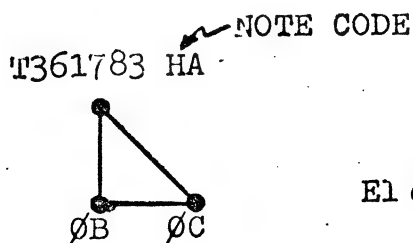
Only two leads need be labeled for those components that require lead codes. The program will assign the others from the library.

If a note code is required with a component, and it is not associated with the component in the library, it must be written after the component part number on the grid sheet.

Axial Leaded Components

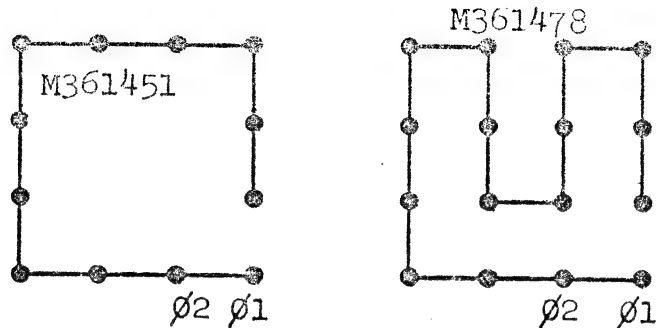
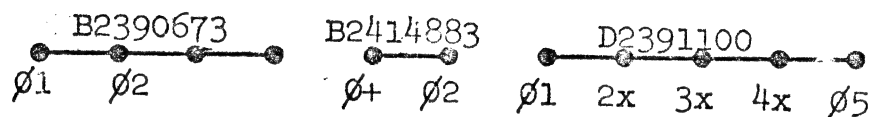
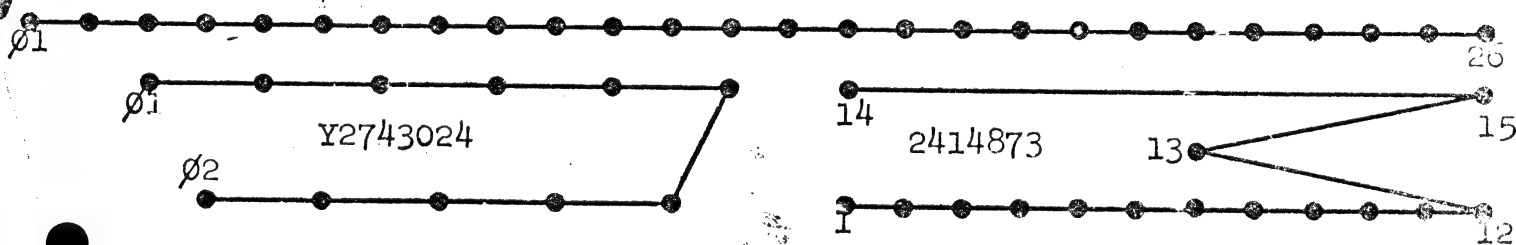
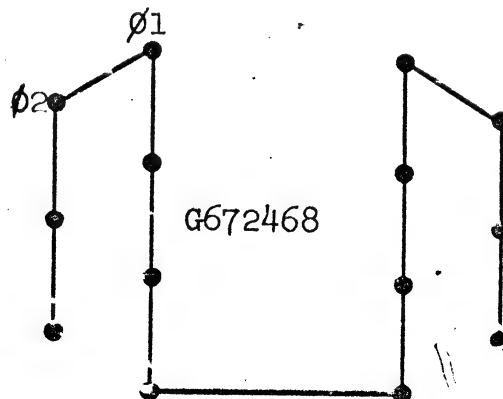
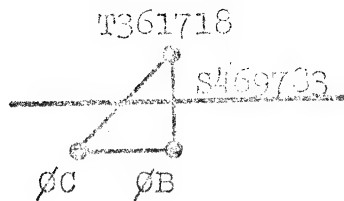
COMPONENT TYPE CODE
COMPONENT P/N
R365123

Axial leaded components with polarity or lead codes should have their codes indicated directly adjacent to the lead that requires the code. Use only a "+" on the positive side of polarized capacitors and an "X" on the cathode side of diodes.

+
C456732 +

X D361742

Transistors & Diodes

NOTE CODE
T361783 HA
ØB ØC

T373482
E1 B1
C1
E1
B2 C2

D2414884
1X
2X Ø3

COMPONENTS (CONTINUED)

Heatsink with Transistor -

T361718

S469733

ØC ØB

SCOPE

Both CCDA and CCRP systems require accurate component data. A card cannot be processed through either system unless its components are described on the respective CLT's.

Although component data can be entered onto the local DA CLT's, a corporate DA CLT is maintained by Department 307, Endicott. Department 307 must be on distribution for any change made by a local DA to their CLT. Notification to Department 307 must be by cards and/or drawings when applicable. On a weekly basis all DA locations and SMD Endicott are updated from Department 307 via a punched card deck. More frequent updating does occur as the need exists, especially the SMD CLT. These update card decks are dated and serially numbered.

Components that are used on SLT cards are released from many locations. Department 307 must be on distribution for these releases. Delays in card processing can result if released component documents are not received in Endicott prior to arrival of the EDT.

The CLT contains information as to the physical dimensions and electrical parameters for components. Listings of the CLT aid Circuit Tech groups in designing circuits, and packaging groups in laying out of cards.

The CLT provides the following information for each component required on a card in the FORMIT and PRESEL series of 1401 CCDA programs:

Physical lead diameter and component shape so the programs can determine hole size.

Length and width for drawing components on the assembly drawing and laying out cards in Phase II.

Technical status to determine whether the restricted note FA is required on the card.

Value field information for the assembly drawing.

Note code when the same code is required each time the component is used.

Orientation code to determine position of non-symmetrical components.

Description of component leads for checking their position, generation of lead codes not required on the input.

COMPONENT LIBRARY TAPE

INPUT	COMPONENT LIBRARY	COMMENTS
ALL LABS	DEV & FORMAL RELEASE	• CORP. RELEASE AND CHANGES OF ALL DEV. AND FORMAL SLT ELECTRICAL COMPONENTS
INTERNAL MAIL		
ENDICOTT 307	CHECK	• CHECK FOR PRESENCE OF SUFFICIENT & CORRECT INFO
	IS INFORMATION CORRECT? (YES / NO)	• SEE CLT SECTION OF CCDA GROUND RULES
	CODE FOR CLT — NOTE	COMPONENT LIBRARY CODING CAN BE DONE AT LOCAL LAB IF EMERGENCY
ENDICOTT DATA PROCESSING	1. KEY PUNCH 2. CUPID RUN 3. REPRODUCE DECK → END (CORP) CLT	• UPDATE RUNS ARE MADE ONCE EACH WEEK OR AS REQUIRED (EMERGENCY)
ENDICOTT 307	CUPID UP-DATE CARDS DISTRIBUTION; CUPID UP-DATE LIST	• DISTRIBUTION CORP. ONCE EACH WEEK END. SMD ONCE EACH WEEK (OR AS REQUIRED-EMERGENCY)
ENDICOTT SMD	SMD COMPONENT LIB UPDATE → MFG. CLT	
INTERNAL MAIL		
LOCAL LAB.	CUPID RUN MERG → CLT LOCAL MASTER ENG. → LOCAL LISTING	• LOCAL DISTRIBUTION OF COMPONENT LIBRARY LISTING IS MADE BY THE LOCAL LAB. FROM THE LOCAL MASTER TAPE. • EMERGENCY LOCAL UPDATE IS MADE BY LOCAL RUN OF "CUPID"

INPUT

Documents -

A properly drafted component drawing. Refer to the Card Layout Ground Rules for required dimensioning.

A component drawing is not considered released until the date block to the left of the EC level block has been filled in by the controlling release processing group.

With just the EC level filled in, it represents an advance of an anticipated change or release; and the drawing can be changed without the issuance of a new or higher EC level. With the date block filled in the only way the drawing can be altered is by a controlled EC change to the component.

Unreleased components must not be placed on the CLT. This is done to protect the users of these components against changes incorporated on the drawing without their consent.

The following chart depicts the various levels of card assemblies and the component EC levels that can be used on them and in the CLT.

Type of Component Part and EC Numbers	Experimental "S" Number Card	Formally Released 580XXXX	Acceptable For CLT Input
Development	yes	no	yes
Formal P/N Advance E.C.	yes	no	no
Formal P/N DV EC	yes	no	yes
Formal	yes	yes	yes

Tapes -

The local CLT and/or corporate CLT are required for component library runs.

INPUT (CONTINUED)

Data Cards -

Rules -

1. Each sequence card and its fields can be changed independently with the exception of "z" cards.

2. All fields must be packed right unless otherwise noted.

3. Each card must have its component part number and type code in columns 1-9.

   Component type codes used in column 9 of each card are as follows:

COMPONENT TYPE	LIBRARY & DA INPUT CODE	CORPORATE DRAWING CODE*
RESISTORS	R	R
CAPACITORS	C	C
DIODES	D	CR
TRANSISTORS	T	Q
SLT, SLD, ASLT MODULES	M	Z
I. C. MODULES (MST-1, MST-2, MST 4, etc.)	G	ZM
R. C. MODULES	B	A
INDUCTORS	L	L
POTENTIOMETERS	P	R
HEAT SINKS	S	HS
CRYSTALS	A	Y
DELAY LINES	Y	DL
REED RELAYS	I	RR
PULSE TRANSFORMERS	X	T
FUSES	F	F
HARDWARE	Q	XX
JUMPERS	J	J
PROGRAM DEVICES	U	U
NOTES	8	N

* These codes appear on the machine generated assembly drawings.

4. With the exception of hardware (Q), jumper (J), note (8), and "Z" action code cards, #1 sequence cards have the same data formats in columns 1-59 and 79, 80.

INPUT (CONTINUED)

Z Cards - are used when the part number specified in Cols. 1-8 is no longer valid. Either the component is Obsoleted, Field Use Only or replaced by some other component.

COLUMNS	DATA
1-8	IBM Component Part Number
9	Component Type Code - see page 4
10-32	Variable Data - Used to describe why this component cannot be used. For example: Replaced by 285396R
79-80	"Z1"

Lead Data Cards - are used to describe the position of all leads, mounting holes, and restricted areas with respect to the center of the component. The CCDA programs use this information to check when they are used on a card.

Lead data must not be input for "A" (tubular axial leaded) and "C" (rectangular axial leaded) shape code components and hardware.

INPUT (CONTINUED)

Listed below are the components and the minimum information required to have the program assign lead data automatically provided the following restrictions are met:

1. No manual lead data cards are input for that part number. If lead data cards are supplied for the component the automatic assignment will be overridden.

2. The shape code is not "A" or "C" (column 35, card 1).

3. The component is being added ("A" in column 79) or the shape code is being changed. When a component is changed the lead data is not automatically recalculated unless the shape code is also changed.

MINIMUM INFORMATION REQUIRED FOR
COMPONENTS WHOSE LEADS ARE AUTOMATICALLY ASSIGNED

Components	Data Card A1-Col. 9	Data Card A1-Col. 33-34	Data Card A1-Col. 35	Data Card A2-Col. 39
Transistors				
To-5, To55	T	03	E or F	
To-18, To66	T	03	E or F	
To-3	T	02, 04	G	
Crystals	A	02	H	1
	A	02	H	3
	A	02	H	2
Potentiometer	P	03	H	
SLT Modules				
12 leaded	M	12	M	
16 leaded	M	16	M	
Heat Sinks				
To-5	S		J	
To-18	S		J	
Integrated CKT Modules				
10 leaded	G	10	L	
14 leaded	G	14	K	
*16 leaded	G	16	M	
R/C Modules				
2 leaded	B	02		
4 leaded	B	04		
6 leaded	B	06		
8 leaded	B	08		

* I/C Mod with SLT layout

INPUT (CONTINUED)

All other component types except those with "A" and "C" shape codes require manual lead data.

Column	Data
1-8	IBM Component Part Number
9	Component Type Code - See page 4
10	"*"

The next series of columns are used to describe the component leads, number or code, and position relative to the center of the component.

12-13 Lead Number or Code of First Lead - All electrical leads must be transcribed first. Electrical leads are to be followed by locating pins, holes in heat sinks for transistor bodies, mounting holes, and restricted areas. Use the following codes in Col. 12, 13 respectively:

- Pn - Locating pins
- Sn - Holes in heat sinks for transistor bodies
- Hn - Mounting holes
- Rn - Restricted areas adjacent to the component on the card; for example, that no circuit lines can be routed through. The CCDA component layout ground rules defines these areas for applicable components.
- n = Any numeric start at 1

The lead numbers shown on the component should be used whenever possible. Exceptions to this rule are outlined below.

The positive side of polarized capacitors must be coded Ø+.**

The cathode lead(s) of diode packages must be coded with their lead number than an x. For example: 1x, 2x, etc.

Transistor leads are coded ØE, ØB, ØC.** If more than one emitter, base, or collector lead is present on a component they must be coded B1, B2, E1, E2, C1, C2.

** Ø = zero

INPUT (CONTINUED)

For those components or leads that are not numbered; 01, 03, etc. must be assigned. For example: Only the four corner leads of reed relays are numbered. Since all leads must be numbered the remaining ones are numbered as shown below. Odd numbers are used on the same side as lead 1 starting with 5 directly adjacent to lead 1.

14	"X" Direction - from center of component for first lead. Use "+" or "_".
15-18	"X" Value - from center of component for first lead in thousandths.
19	"Y" Direction - from center of component for first lead. Use "+" or "_".
20-23	"Y" Value - from center of component for first lead in thousandths.
25-36	Second lead field.
38-49	Third lead field.
51-65	Fourth lead field.
64-75	Fifth lead field.

Lead values or positions are determined by bisecting the component horizontally and vertically while viewing it from the top as if, it was inserted into a circuit card with its longest dimension along the "X" axis. If the first leads on either side of the center axis are equidistant from the axis but cannot be divided equally the odd value thousandths position is placed on the positive X and/or Y side or in the positive X and/or Y field. The spacing for all other leads is then added to the value determined for the first ones. The following fictitious reed relay is used to illustrate how the information for these columns is determined.

INPUT (CONTINUED)

Y+

ODD THOUSANDTHS VALUE IN POSITIVE FIELD

.975

.488 .487

.087 R1

.187 .063

.200

−X .595 X+

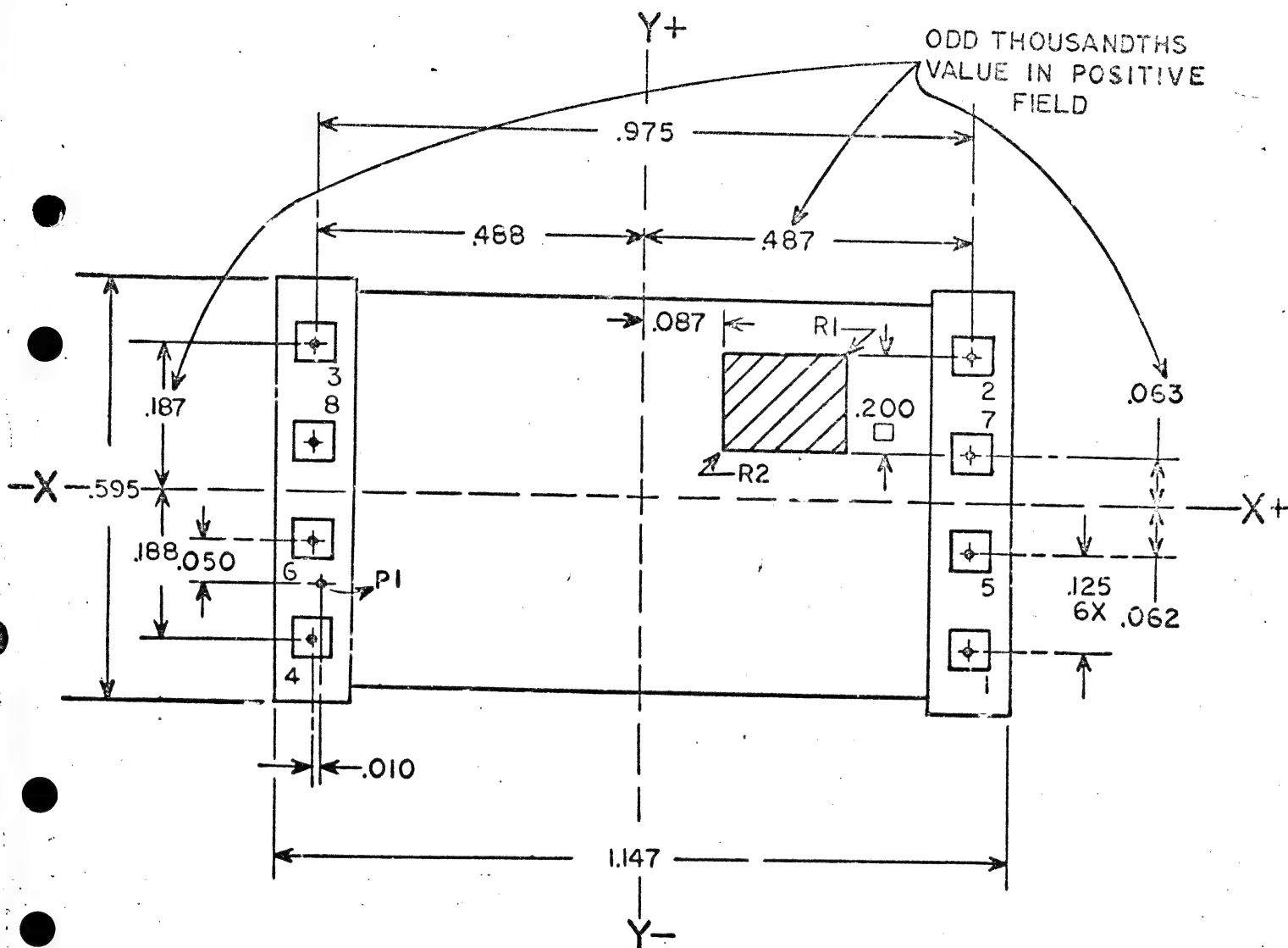
R2

.188 .050 P1

.125 6X .062

.010

1.147

Y−

Col.	Code	Col.	Dir.	Col.	Val.	Col.	Dir.	Col.	Val.
12, 13	01	14	+	15-18	.487	19	−	20-23	.188
25, 26	02	27	+	28-31	.487	32	+	33-36	.187
38, 39	03	40	−	41-44	.488	45	+	46-49	.187
51, 52	04	53	−	54-57	.488	58	−	59-62	.188
64, 65	05	66	+	67-70	.487	71	−	72-75	.062
12, 13	06	14	−	15-18	.488	19	−	20-23	.062
25, 26	07	27	+	28-31	.487	32	+	33-36	.063
38, 39	08	40	−	41-44	.488	45	+	46-49	.063
51, 52	P1	53	−	54-57	.478	58	−	59-62	.112
64, 65	R1	66	+	67-70	.287	71	+	72-75	.188
12, 13	R2	14	+	15-18	.087	19	+	20-23	.063

INPUT (CONTINUED)

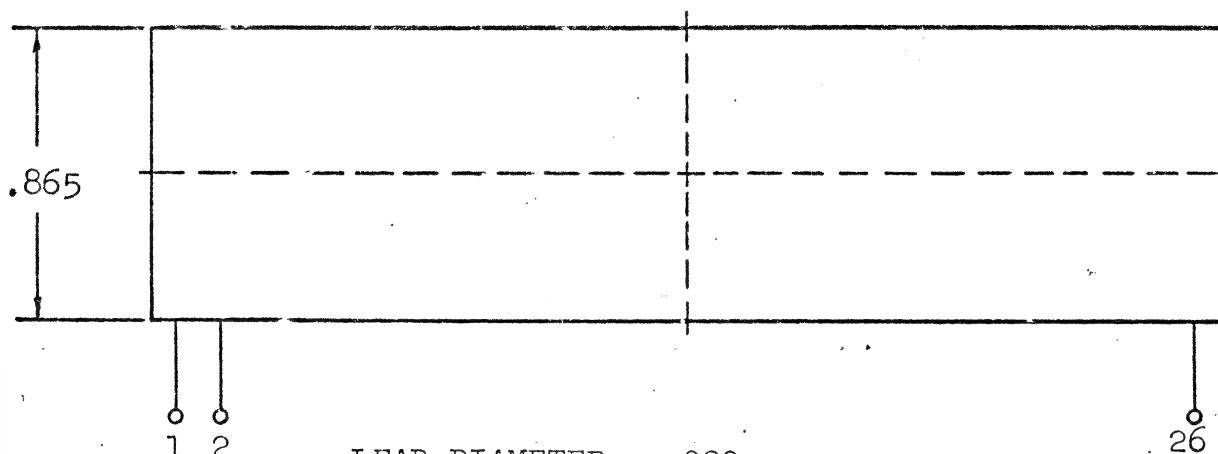
The formula to use for some delay lines with flexible leads extending from the body parallel to the card and bent 90° for insertion into the card is:

$$\text{LEAD VALUE} = \frac{\text{BODY WIDTH or LENGTH}}{2} + .062 + \frac{\text{LEAD DIAMETER}}{2}$$

EXAMPLE

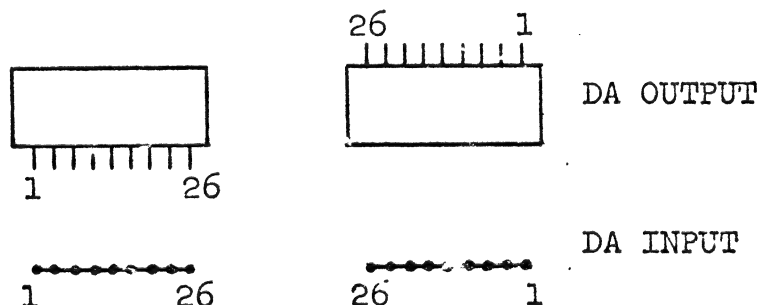
.865

1 2

26

LEAD DIAMETER = .020
Y LEAD VALUE = .505

The component's lead data is used to position the component on the card. A straight line connecting leads 1-26 would be all that is required. If lead 01 was coded as the left lead as shown then the component body would be drawn above the leads as shown above. If lead 01 was coded at the right then the component would be drawn below the leads.

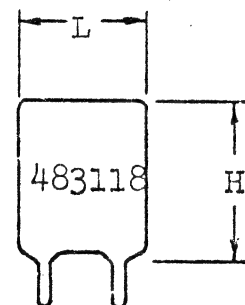
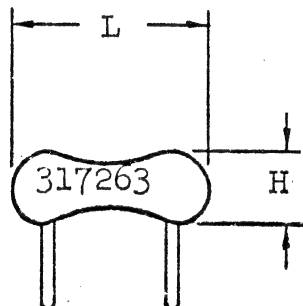
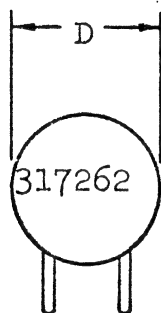
1 26 | 26 1 | DA OUTPUT

1 26 | 26 1 | DA INPUT

INPUT (CONTINUED)

Disc, dipped mica. and "dog-bone" capacitors, such as part numbers 317262, 483118, and 317263 respectively are radial leaded components which have their leads formed to fit on the standard .125 inch grid.

The following table must be used to determine the proper lead spacing for these types of capacitors:

MAX. LENGTH OR DIAMETER OF COMPONENT (See Drawings Below)	LEAD SPACING
up to .249	.125
.250 to .599	.250
.600 to 1.000	.375
1.000 to 2.000	.500

D 317262 L 317263 H L 483118 H

Column	Data
79	Action Code - See component data cards Col. 79
80	Sequence Number - 4-9 then A-Z as required.

Component Data Cards - Col. 1-59 of all component data cards with sequence #1 require the same format. Pack right* in all fields unless otherwise designated.

Columns	Data
1-8	IBM Component Part Number
9	Component Type Code - See Page 4
10	Engineering Status

R or A Active when no restriction code is on the drawing

R or A Active when no restriction code is on the drawing
C Controlled
D Field use only
P,Q,X When the drawing has a development P/N or Development EC number

INPUT (CONTINUED)

Columns	Data
	F A military component released through Federal Systems for usage on Federal Systems cards only.
	O When a component is obsoleted.
11-17	Engineering Change Number
18-19	Maximum Lead Diameter in Thousandths Decimal and Zero (0) are automatically assumed and should not be inputted Ex . .025 would be inputted as "25."
20-23	Maximum Length in Thousandths The longest dimension as the component would normally be laid on the card The decimal is assumed automatically between Cols. 20 & 21. All spaces to the right of the decimal must be filled Ex. 1.1" Body Length would be inputted as 1 100
24-27	Maximum Width in Thousandths(Pack Right*) The decimal is assumed automatically between Cols. 24 & 25. All spaces to the right of the decimal must be filled
28-30	Maximum Height in Thousandths The decimal is assumed automatically before Col. 29. All spaces must be filled
31	Drawing Size
32	Technical Services Status

A	Approved- Full usage	F	Failed
B	Conditional Usage	L	Not evaluated
C	Limited	N	No evaluation required
E	Controlled Usage	R	Restricted

Columns	Data
33-34	Number of Leads on Component
35.	Shape Code

A Tubular with axial leads
B Disc or Dog bone
C Rectangular with axial
E Transistors with To5 and To55 or To18 and To56 outline part no.
F Transistors with two base leads and a To5 and To55 or To18 and To56 outline.

*Pack Right - starting at the farthest right column of the field, information should be filled in from right to left, with any unused columns appearing to the left of the number.

INPUT (CONTINUED)

Columns — Data

35 — Shape Code (continued)

- G - Transistors with T03 outline part number.
- H - Potentiometer, crystal, delay line, pulse transformer, reed relay.
- J - Gear type heat sink.
- K - 14 leaded I. C. module
- L - 10 leaded I. C. module
- M - SLT Module 12 or 16 leads - I/C Mod
- R - R/C Modules 2, 4, 6, 8 leads.
- Z - All others not covered.

36-37 — Process Restrictions or Note Code - If the same note code is always used with a component, it should be entered here. (See card layout ground rules)

38 — Insulation Code - 1 - Insulated
2 - Non-insulated

39 — Character Code

- A - Assembly
- D - Detail
- R - Reference

40 — Orientations Allowed on Card

- H - Horizontal
- V - Vertical
- B - Horizontal or Vertical

41-43 — Mounting Hole Diameter of Component in Thousandths

44-59 — Blank

All component data cards Cols. 79-and 80 use the following format:

Columns — Data

79 — Action Code

- A - Add initial input to the library.
- C - Change or add component data to an existing component on the CLT.
- D - Delete component from the CLT columns 1-9, 79 80 only are required for this type of card.
- Z - Replace info with cross reference.

80 — Sequence Number
~~Each data card~~ for a component has a sequence number (1,2,3, etc.) with the exception of note cards which always have a one (1).

INPUT (CONTINUED)

Columns	Data
60-65	Resistors - Card 1 continued
	Resistance Value - Decimal understood between 62 and 63. Convert all values as follows:
	For .001 -999.999 use .001 - 999.999
	For 1,000. -999,999 use 1. - 999.999
	For 1,000,000. - 999,999,000. use 1. - 999.999
66	Resistance Value Multiplier
	Blank = 1
	K = 1,000
	M = 1,000,000
67-70	Plus Tolerance in Per Cent
71-73	Minus Tolerance in Per Cent
74-78	Wattage in Watts - Decimal understood between 75-76
	Resistors - Card 2
17-20	Temperature Coefficient in % Change Per C^{o}
21-24	Resistor Type
	CARB - Carbon Composition
	PWRF - Power Film
	GPF - General Purpose Film
	PREF - Precision Film
	GPW - General Purpose Wire Wound
	PWPW - Power Wire Wound
	PREW - Precision Wire Wound
	THER - Thermistor
	SENS - Sensistor
	TERM - Terminating Resistor
	META - Metal glaze (Cermet)
25-29	Inductance in Microhenries
30-31	Min. Lead Diameter in Thousands
32-35	Min. Length in Thousands
36-39	Min. Width in Thousands
40-42	Min. Height in Thousands
43-50	Physical Outline Code

INPUT (continued)

Columns	Data
	Capacitors - Card 1 continued -
60-65	Capacitance Value - Decimal understood between 62 and 63. Convert all values as follows: For 999.999 uf - 1.000 uf use 999.999 - 1.000 For .999 uf - 1.000 nf use 999. - 1.000 For .999 nf - .001 pf use 999. - .001
66	Capacitance Value Multiplier - U = .000,001 N = .000,000,001 P = .000,000,000,001
67	Polarity N = Non Polarized P - Polarized
	Capacitors - Card 2
10-13	Plus Tolerance
14-16	Minus Tolerance
24-27	Temperature coefficient in % change Per C°
28-31	Capacitor Type Mica - Mica Tant - Tantalum Alum - Aluminum Electrolytic Cerm - Ceramic Film - Polyesterfilm Carb - Polycarbonate **STYR - Polystyrene**
32-35	DC Working Voltage
36-38	Surge Voltage
39-40	Min. lead diameter in thousandths
41-44	Min. length in thousandths
45-48	Min. width in thousandths
49-51	Min. height in thousandths
52-59	Physical outline code
	Diode - Card 1 continued
60-62	Type - FA, HB, etc.
	Diode - Card 2
10-17	Physical Outline
18-19	Min. lead diameter in thousandths
20-23	Min. length in thousandths
24-27	Min. width in thousandths
28-30	Min. height in thousandths
40-44	Package - Glass, Metal, Epoxy

INPUT (CONTINUED)

Columns	Data
	Transistor - Card 1 continued
60-62	Type Numbers - 125, 103, etc.
63-66	Type of Transistor - NPN, PNP, etc.
67-74	Physical Outline
	SLT Modules - Card 1 continued
60-64	Module Family - SLT, SLD, ASLT, C-50, MSM, M-250 (Pack left)
65-67	Family - in Nano-seconds
71-75	Decoupling B Factor - Decimal understood between 73-74. See Decoupling section of Card Layout Ground Rules (Suffix 3, Section 5). This information is used by Phase II to determine the decoupling required on a card.
76-77	Restriction Code 1 - No restrictions 2 - AOI11 3 - LTN 4 - LSA See previous field for use
	SLT Modules - Card 2
10-17	Physical Outline
	I-C Modules - Card 1 continues
60-64	Module Family: MST-1, MST-2, MST-4, (Pack left) DIP (Dual in line module) FLAT (Flat Packs)
65-78	Verbal description of the module function. For example: 2-3 way AOI.
	I-C Modules - Card 2
10-17	Physical Outline

INPUT (CONTINUED)

Columns	Data
	R/C Modules - Card 1 continued
60-63	Lead Spacing
64	Polarity Indicator P = Polarized N = Non Polarized
65-72	Physical Outline
	R/C Modules - Card 2
10-14	Resistance Value (R1)
15	Multiplier (M1) Blank = 1 K = 1,000 M = 1,000,000
16-18	Max. Pwr. Capacity in Milli Watts (P1)
19-23	R2
24	M2
25-27	P2
28-32	R3
33	M3
34-36	P3
37-41	R4
42	M4
43-45	P4
46-50	R5

INPUT (CONTINUED)

Columns	Data
51	M5
52-54	P5
55-59	R6
60	M6
61-63	P6
64-68	R7
69	M7
70-72	P7
73-75	End of Life Plus Tolerance - Initial tolerance x 1.5
76-77	End of Life Minus Tolerance - Initial tolerance x 1.5

INPUT (CONTINUED)

Columns	Data
	R/C Modules - Card 3
10-13	Capacitance Value (C1)
14	Multiplier (M1) U = .000,001 N = .000,000,001 P = .000,000,000,001
15-17	DC Working Voltage (WV1)
18-21	C2
22	M2
23-25	WV2
26-29	C3
30	M3
31-33	WV3
34-37	C4
38	M4
39-41	WV4
42-45	C5
46	M5
47-49	WV5
50-53	C6
54	M6
55-57	WV6
58-61	C7
62	M7
63-65	WV7

INPUT (CONTINUED)

Columns	Data
66-68	End of Life Tolerance Plus Value

1. Ceramic Capacitors
   Class I - print tol ± 3%
   Class II - print tol ± 20%

2. Tantalum Capacitors
   Class I - print tol +0% - 20%
   Class II - print tol +0% - 25%
   Class III - print tol +07% - 15%

3. Mylar Capacitors - print tol ± 20%

4. Mica Capacitors - print tol ± 3%

Columns	Data
72-73	Class
74-76	EIA Characteristic

INPUT (CONTINUED)

Columns	Data
	Inductors - Card 1 continued
60-65	Inductance Value - Decimal understood between 62 and 63. Convert all values as follows: For 999.999H - 1.000H use 999.999 - 1.000 For .999H - 1.000 MH use 999. - 1.000 For .999MH - .001UH use 999. - .001
66	Inductance Value Multiplier Blank = 1 M = .001 U = .000,001
67-70	Inductance Value Test Frequency
71	Test Frequency Multiplier Blank = 1 K = 1,000 M = 1,000,000
	Inductors - Card 2
10-13	Plus Tolerance
14-16	Minus Tolerance
17-20	I Max. in Ma.
24-25	Q Factor
26-29	Q Factor Test Frequency
30	Test Frequency Multiplier Blank = 1 K = 1,000 M = 1,000,000
31-33	Self Resonant Frequency
34-36	DC Resistance in Ohms
40-41	Min. Lead Dia.
42-45	Min. Length
46-49	Min. Width
50-52	Min. Height
53-60	Physical Outline

INPUT (CONTINUED)

Columns	Data
	Potentiometers - Card 1 continued
60-78	See Resistors Data Card Columns 60-78
	Potentiometers - Card 2
10-20	Same as resistors
23-24	Potentiometer Type WW - Wire Wound CR - Carbon Film CC - Carbon Composinon MG - Metal glaze (Cermet)
43-50	Physical Outline
	Heat Sinks - Card 1 continued
60-65	Transistor Outline Part Number - TO-5, TO-18, etc.
	Heat Sinks - Card 2
10-13	K Factor in C° Per Watt
14-16	K Factor Air Flow Parameter
17-20	K Factor in C° Per Watt
21-23	K Factor Air Flow Parameter

INPUT (CONTINUED)

Columns	Data
	Crystals - Card 1 continued
60-65	Nominal Frequency - Decimal understood between 62 and 63. Convert frequency as follows: For .001 - 999.999 use .001 - 999.999 For 1,000 - 999,999 use 1. - 999.999 For 1,000,000 - 999,999,000 use 1. - 999.999
66	Nominal Frequency Multiplier Blank = 1 K = 1,000 M = 1,000,000
	Crystals - Card 2
10	Temperature - A - 25° C B - 10° C to 60° C
11-13	Z Min
14	Z Min Multiplier Blank = 1 K = 1,000 M = 1,000,000
15-17	Z Max
18	Z Max Multiplier Blank = 1 K = 1,000 M = 1,000,000
19-21	Max Drive Level
22	Max Drive Level Multiplier Blank = 1 M = .001 U = .000,001
23-25	C_L
26	C_L Multiplier U = .000, 001 P = .000, 000, 001

INPUT (CONTINUED)

Columns	Data (Crystals) - Card 2
27-28	C_L ± % Tolerance
29-31	C_O
32	C_O Multiplier U = .000,001 P = .000,000,001
33-34	C_O ± % Tolerance
35-38	Purchase Tolerance
39	Crystal Package Type 1 - Type I 2 - Type II 3 - Type III Types are defined in Card Layout Ground Rules. (Suffix 3, Section 14)
40-47	Physical Outline
	Delay Lines - Card 1 continued
60	Unit Designation M - MICROSEC N - NANOSEC
61-64	Maximum Delay
	Delay Lines - Card 2 continued
10-13	Second Longest Delay
14-17	Third Longest Delay
18-21	Fourth Longest Delay
22-24	Fifth Longest Delay
25	Delay Time Tolerance A - 5% B - 10%
26-29	Rise Time
30-32	Z / Impedance

INPUT (CONTINUED)

Columns	Data (Delay Lines)
33	Z Multiplier
34-35	Max Distortion
36-38	Insertion Loss
39-42	DC Resistance
43-44	Max Volts
45-52	Physical Outline

Reed Relays - Card 1 continued

60-61	Number of Contacts
62-63	Number of N/O Contacts
64-65	Number of N/C Contacts
66-73	Coil Part No.

Reed Relays - Card 2

10-13	Nom. Pick Coil Current in Milliampreres
14-17	Nom. Hold Coil Current in Milliamprreres
18-21	Max. Operating Range Volts at N1 in Volts
22-23	NT - For Operatlng Range
24-27	Min. Release Range Volts at N1 in Volts For Pick Coil
28-29	NI - For Pick Coil Release
30-33	Min. Release Range Volts at N1 in Volts For Hold Coil
34-35	NI - For Hold Coil Release

INPUT (CONTINUED)

Columns	Data
	Pulse Transformers - Card 2
10-14	Primary Resistance in OHMS
15-16	± % Tolerance of Primary Resistance
17-21	Secondary Resistance in OHMS
22-23	± % Tolerance of Secondary Resistance
24-28	Transformation Ratio
29-30	± % Tolerance of Transformation Ratio
31-33	Input Volts RMS
34	Input Voltage Multiplier Blank - 1 M - .001
35-38	Leakage Inductance in Microhenries
39-42	Primary Inductance in Microhenries
43-45	Primary Inductance Plus Tolerance
46-48	Primary Inductance Minus Tolerance
49-56	Physical Outline
	Fuses - Card I continued
60-65	Current Rating in Amperes
66-68	Voltage Rating in Volts
	Hardware - Card 1 continued
1-17	Use regular input format
18-30	Blank
33-38	Blank
40-49	Noun name of part. ex: Screw
50-69	Adjective Description of part. Ex. 10-32 x 1.5 etc.

INPUT (CONTINUED)

Columns	Data
	Jumpers - Card 1 continued
28-30	Blank
33-37	Blank
40-69	Description of Jumper
	Program Caps - Card 1 continued
60-70	"Program Cap"
	Process Restriction Notes
1-2	Note Code
3-4	Note Code Line Sequence Number
9	"8"
10-19	Part Number for Special Components
20-21	Unit of Measure
22-23	Quantity Used Per Component
24-53	Verbal Description
79	Action Code (See page 13 of 41)
80	Card Sequence Number Sequence Number for note cards is always one (1).

SCOPE

This section contains the input rules for special or reference information which will extend the value of the component library as an informational type document as well as a functional document.

PHYSICAL OUTLINE CODES

Physical outline codes are being released as Engineering Specifications (Ex. Physical outline 6A805A4 has been released as Engineering Spec. 873595). Therefore, in order that there will be a cross reference in the library, the specification numbers are to be input according to the following rules:

The regular input format (Suffix 4, Section 3A) should be used for columns 1 through 59 and 79 through 80 unless otherwise stated.

R/C Module - Physical Outline

Column	Data
Card 1	
39	Character Code R=Reference
60-63	Lead Spacing
64	Polarity Indicator P=Polarized N=Non-Polarized
65-72	Physical Outline Code Ex. 6A805A4
Card 2	
1-8	Part Number
9	Part Type "B"
10	Leave Blank

Column	Data
11-14	Ref.
15	Leave Blank
16-18	PHY
19-23	OUTL.
24	Leave Blank
25-27	Number of Leads (2-L; 4-L; 6-L; 8-L)
	Ex. 2-L means a two leaded unit

Card 3

Column	Data
1-8	Part Number
9	Part Type "B"
10-13	Ref.
14	Leave Blank
15-17	PHY
18-21	OUTL.
22	Leave Blank
23-25	Number of Leads (2-L; 4-L; 6-L; 8-L)

SLT MODULE - PHYSICAL OUTLINE

Column	Data
Card 1	
39	Character Code
	R = Reference
60-64	Ref.
65-66	PO (Physical Outline)

Column	Data
Card 2	
1-8	Part Number
9	Component type "M"
10-17	Physical Outline Code

TRANSISTOR - PHYSICAL OUTLINE

Card 1	
39	Charactor Code
	R=Reference
60-62	PHY
63-66	OUTL.
67-74	Physical Outline Code

DIODE- PHYSICAL OUTLINE

Card 1	
60-62	Ref.
Card 2	
1-8	Part Number
9	Component type "D"
10-17	Physical Outline Code
40-44	PHOUT (Physical Outline)

I-C MODULE - PHYSICAL OUTLINE

Card 1	
60-63	REF.
65-68	PHY.
70-73	OUTL.
75-78	Number of Leads (Ex. 14-L; 32-L)

I-C MODULE - PHYSICAL OUTLINE (continued)

Column	Data
Card 2	
1-8	Part Number
9	Component Type "G"
10-17	Physical Outline Code

COMPOSITE OR FAMILY MATRIX DRAWING IDENTIFICATION

A system has been established to indicate which component part numbers are contained on matrix drawings. Part numbers contained on matrix drawings will be indicated in the Physical Outline column by the following code - "M xxxxxxx" where "M" stands for "Matrix" and "xxxxxxx" is the part number of the matrix drawing.

Ex. P/N 842275 is a precision metal film resistor and is contained on matrix drawing 842000. Therefore, M842000 will appear in the physical outline column for this part.

This coding system will appear in the following library sections:

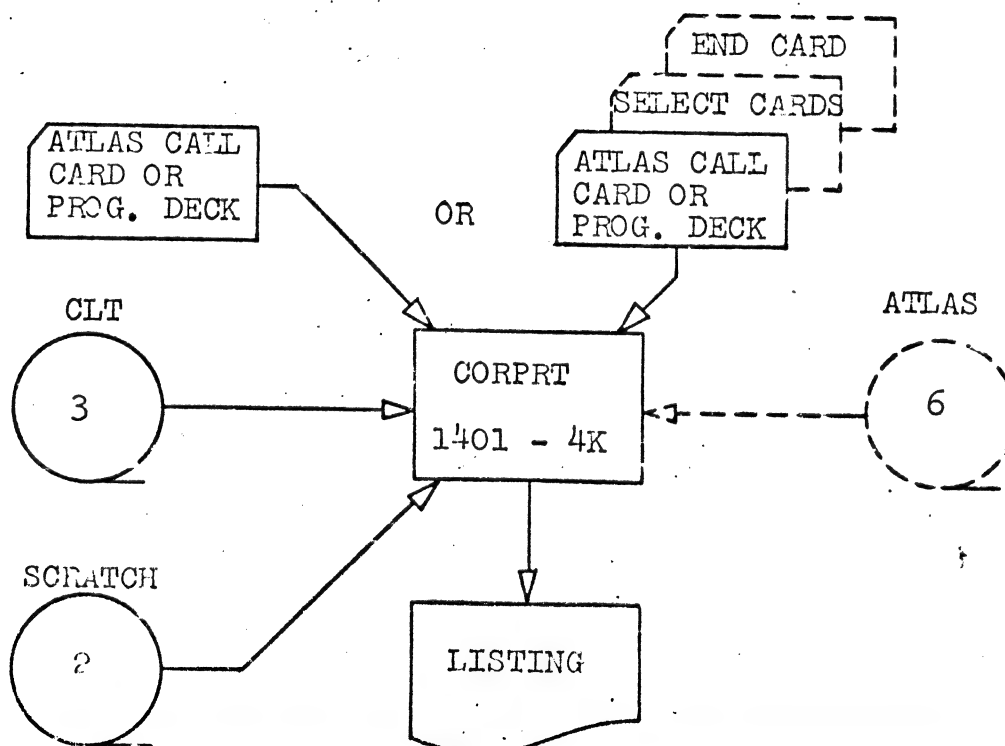
Resistors
Capacitors
Inductors
Potentiometers

SCOPE: This section contains the updating and run programs for the CLT.

PROGRAMS

CORPRT

This 1401 -4K program runs approximately 20 minutes and is used to list the following data for each component on the CLT.

a. IBM part number
b. Maximum physical dimensions of component: lead dia, body length, body width, body height.
c. Number of electrical leads which are inserted into the circuit card.
d. Body shape code.
e. Process restriction note code.
f. Component orientation code.
g. Insulation code.
h. Mounting hole dia. size in thousands.
i. Location description of component leads.
j. Component description.

PROGRAMS (CONTINUED)

COMPRT -

This 1401 - 4K program runs approximately 20 minutes and is used to list the following data for each component on the CLT.

a. IBM Part No.

b. Latest Engineering change number

c. Maximum physical size in inches-lead dia., body length, body width, and body height.

d. Drawing size

e. Technical status code

f. Engineering status

g. Applicable electrical parameters or description for each component

COMPRT DATA FLOW

ATLAS CALL CARD OR PROG. DECK

CLT

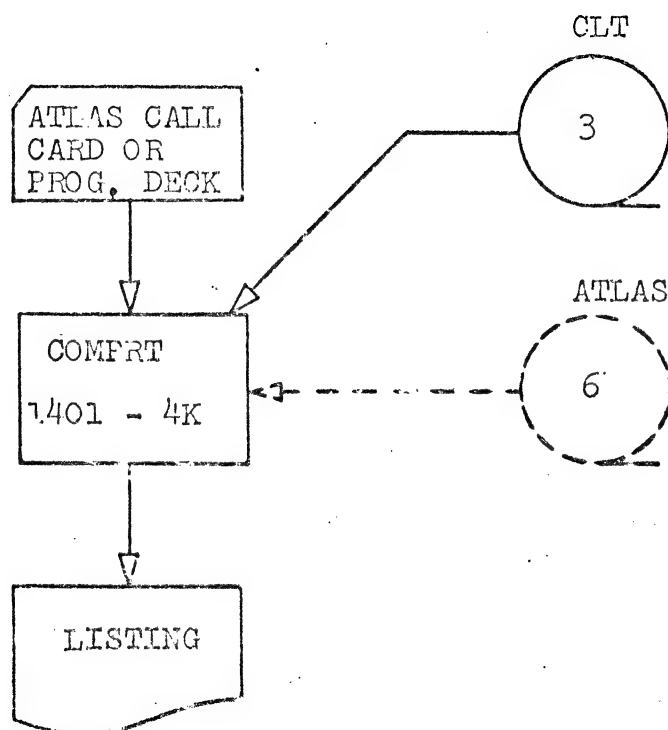
3

COMPRT

1401 - 4K

ATLAS

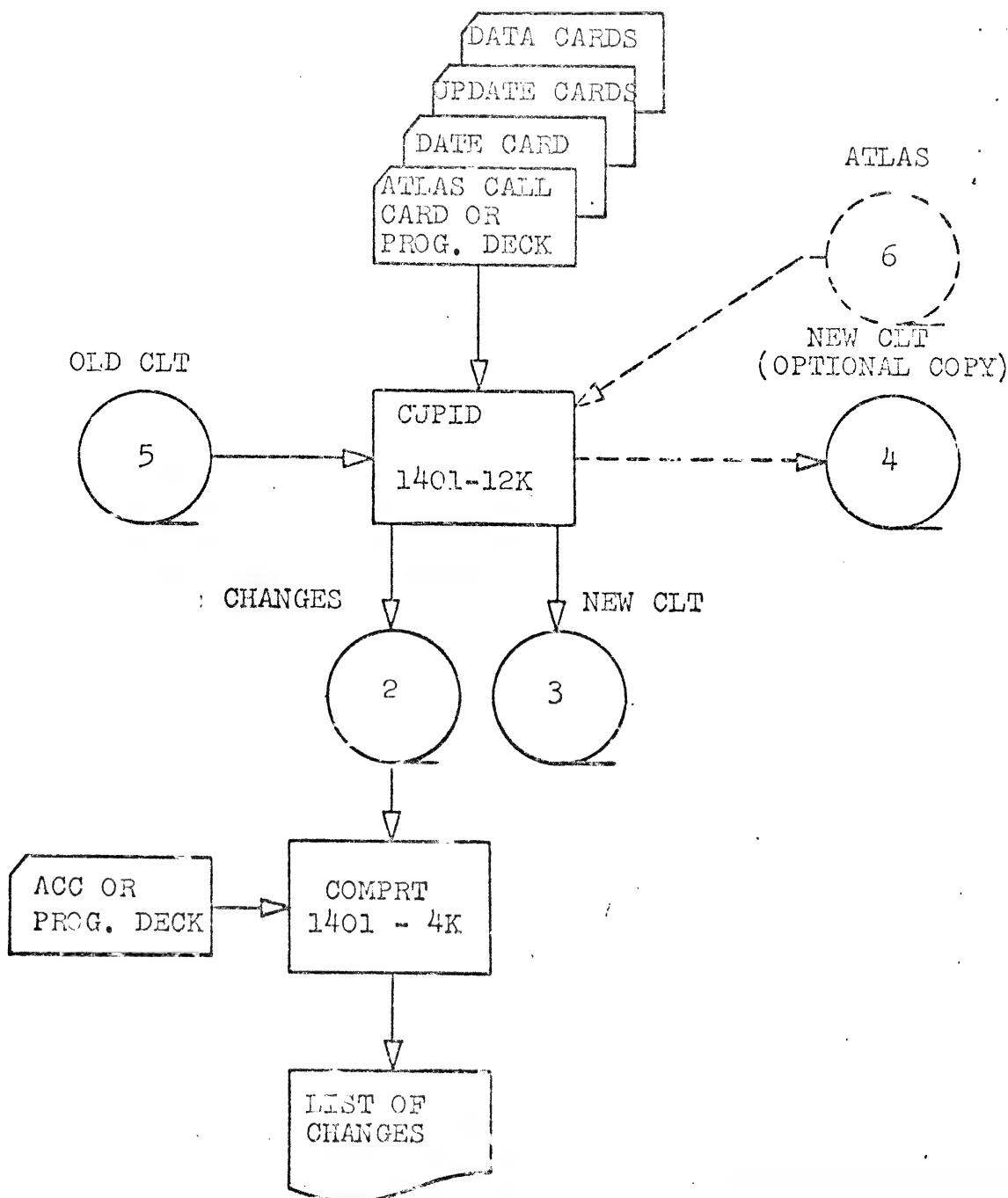
6

LISTING

PROGRAMS (CONTINUED)

CUPID -

This 1401 - 12K program is used to add, delete, and change components on the CLT. Running time is a function of the size of the DATA deck and the CLT. Presently an average run takes approximately 10 minutes.

CUPID DATA FLOW

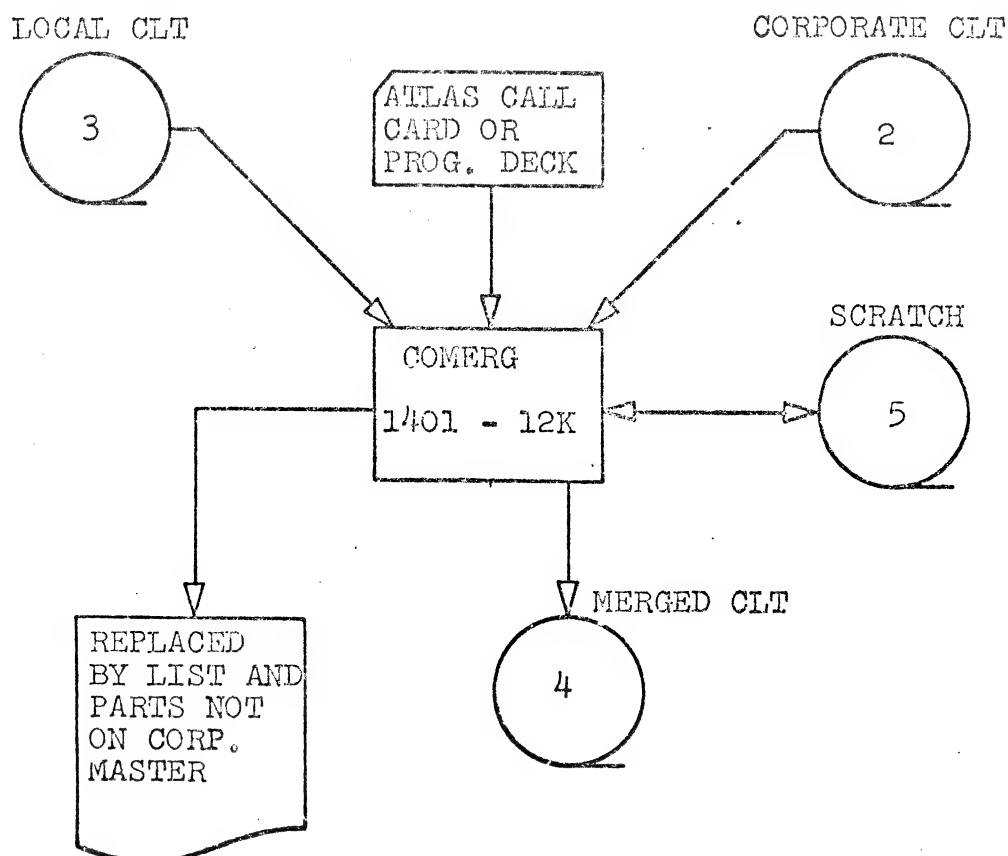
DATA CARDS
UPDATE CARDS
DATE CARD
ATLAS CALL CARD OR PROG. DECK
ATLAS
6
OLD CLT
5
CUPID
1401-12K
NEW CLT (OPTIONAL COPY)
4
CHANGES
2
NEW CLT
3
ACC OR PROG. DECK
COMPRT
1401 - 4K
LIST OF CHANGES

PROGRAMS (CONTINUED)

COMERG -

This 1401 - 12K program is used to merge Local CLT's with the CORPORATE MASTER CLT. Running time is approximately 10 minutes.

COMERG DATA FLOW

SET UP & PROCESSING (CONTINUED)

CORPRT -

Deck -

a. ATLAS call card or program deck.

Select Deck -

a. ATLAS call card or program deck.

b. Select Cards. - If these cards are inserted in the program deck they must be inserted between the first subroutine and the main routine.

Column	Data
1-8	Part Number - (Right Adjusted) If the entire file for a particular component type is required leave blank.
9	PART TYPE

c. End Card -

Column	Data
1-3	"END"

Tape Assignments -

DRIVE	TAPE
2	Scratch
3	CLT

Sense Switch Options -

SS	
A	ON

COMPRT -

Deck -

a. ATLAS call card or program deck.

Tape Assignments -

DRIVE	TAPE
2	CLT

SET UP & PROCESSING

CUPID -

Deck -

a.Atlas Call Card or Program Deck.

b.Date Card

Column	Data
1-4	"DATE"
7-9	Month (JAN., FEB., etc.)
11-12	Day (01, 02, etc.)
15-16	Year (1965, etc.)

c.Update Date Card

Column	Data
1-6	"UPDATE"
9-12	I/P Tape Reel Number
13-16	O/P Tape Reel Number

d.Data Cards -

They must be in sequence by Part type as they appear on the component tape and in ascending part number order within the part type. The component types are on the CLT in the following order:

FILE	PART TYPE CODE
RESISTORS	R
CAPACITORS	C
DIODES	D
TRANSISTORS	T
MODULES	M
I. C. MODULES	G
R. C. PACS	B
INDUCTORS	L

SET UP & PROCESSING (CONTINUED)

FILE	PART TYPE CODE
POTENTIOMETERS	P
HEAT SINKS	S
CRYSTALS	A
DELAY LINES	Y
REED RELAYS	I
PULSE TRANSFORMERS	X
FUSES	F
HARDWARE	Q
JUMPERS	J
PROGRAM CAPS	U
NOTES	8

Tape Assignments -

DRIVE	TAPE
2	SCRATCH (will contain printable list of changes)
3	New CLT
4	Copy of new CLT (optional)
5	INPUT on Master CLT
6	ATLAS (Optional)

Sense Switch Options -

SS	
A	ON
B	ON--A new CLT will be produced on drive 3 and 4. OFF-One new CLT will be produced on drive 3.
C	ON-Calls CORPRT from ATLAS at end of run.

[illegible] PROCESSING (CONTINUED)

COMBRG -

Deck -

a. ATLAS call card or program deck.

Tape Assignments

DRIVE	TAPE
2	Corporate master CLT
3	Local CLT
4	Merged CLT
5	Scratch
6	ATLAS (optional)

Sense Switch Options -

SS	
A	ON

OUTPUT

CUPID -

Documents -
See CUPID section of program description.
Comments -

The following comments cause the input to be omitted from the output.

"NOT IN FILE (PART NUMBER AND TYPE)" The change requested cannot be made is not in the file because this part number.

"ALREADY IN FILE (P/N - TYPE)" This part number cannot be added to the tape because it already exists.

"LEAD DIA. BAD (P/N - TYPE)"

"LENGTH BAD (P/N _ TYPE)"

"WIDTH BAD (P/N - TYPE)"

"HEIGHT BAD (P/N _ TYPE)"

"ORIENTATION BAD (P/N - TYPE)"

"INSULATION BAD (P/N - TYPE)"

OUTPUT (CONTINUED)

"ERROR IN LEAD DATA (P/N - TYPE)"

"SHAPE CODE BAD (P/N - TYPE)"

"NUMBER OF LEADS/TYPE BAD (P/N - TYPE)"

"LEAD DATA MISSING (P/N - TYPE)"

"LEAD CARD SEQUENCE (P/N - TYPE)"

"PART NO. SEQUENCE (P/N - TYPE)"

"PART TYPE SEQUENCE/NOT IN FILE (P/N - TYPE)"

The following comments have no effect upon the processing of the CORPRT data.

"ENGR. STATUS BLANK (P/N - TYPE)"

"TECH. STATUS BLANK (P/N - TYPE)"

"EC BLANK (P/N - TYPE)"

Messages

"BEGIN (UPDATE OR GENERATE) RUN. THIS RUN MADE ON (DATE FROM DATE CARD)"

OUTPUT HEADER LABEL IS (OUTPUT HEADER)"

"RECORD COUNT (NUMBER OF LOGICAL RECORDS EXCLUDING HEADER, TRAILER, END OF FILE MARKS, AND NINES PADDING RECORDS); BLOCK COUNT (NUMBER OF PHYSICAL RECORDS EXCLUDING HEADER, TRAILER, AND END OF FILE MARKS)"

Halts	REASON
LOCATIONS	"GENERATE/UPDATE CARD MISSING. START OVER."
11991	The second control card is the generate/update card. It must have either the word GENERATE or the word UPDATE punched in columns one through eight. After correcting the error, place the control cards followed by the data deck in the reader, ready the reader and press start.
	"EOF AFTER HEADER MISSING. START OVER."
11991	This printout occurs if there is no end of file mark following the header label on the input master tape.

OUTPUT (CONTINUED)

LOCATIONS	REASON
11991	"INPUT REEL NO. DOES NOT CHECK"
	Either an incorrect input reel number was punched in the second control card, or the wrong reel is on the input tape drive. (Drive #5) After taking the corrective action required, place the control cards followed by the data deck in the reader, ready the reader and push start.
11999	"END OF JOB"
	This is the end of this run.
11987	"10 RD ERRS #5. HIT START".
11995	"20 WR ERRS. HIT START."
11999	"REEL (X) TOO SHORT"
	Place a longer reel on the output tape drive. (X) Must restart from scratch.
11991	"DATE CARD MISSING. START OVER"
	The date card must have "DATE" in columns 1-4. After correcting the error in the date card, place the control card followed by the data deck in the reader. Ready the reader and press start.

Tapes

An updated CLT (s)

A tape containing the adds, deletes, and changes that were executed during the CUPID run.

CORPRT -

Documents -

See CORPRT section of program descriptions.

ERRATA

OUTPUT (CONTINUED)

Messages -

"ERROR IN HEADER LABEL"

The header label does not have the word "COMPONENTS" in Cols. 21-30. Mount correct tape and push start.

"HEADER LABEL IS"

This message is followed by the 80 character header label.

"EOF AFTER HEADER MISSING"

The end of file that should follow the header label is missing. Pushing start rewinds the tape and starts the program over again.

"PART NO. OUT OF SEQUENCE"

The specified part number is out of sequence and will not be put on the card to tape output.

"PART TYPE BAD"

The part type is either a non-legal one (see CUPID write up) or it is out of sequence.

"NOT IN FILE"

This part number is not in the specified file.

"LEAD DATA MISSING"

The program found that a lead data continuation record is missing for this part number.

"END OF JOB"

End of run message.

Halts -

LOCATION	REASON
1217	Final halt program is at end of job.
1278	Twenty read errors. No message is printed. Push start to try twenty more times.
514	Header label does not have the word "COMPONENTS" in columns 21-30. Mount correct tape and push start.

OUTPUT (CONTINUED)

LOCATION	REASON
567	EOF after header label is missing. Mount correct tape and push start.

Tapes -

None

COMPRT -

Documents -

See COMPRT section of program descriptions.

Errata -

Halts

"INPUT HEADER LABEL DOES NOT CHECK. MOUNT CORRECT REEL AND PUSH START."

The input reel must have the word "CHANGE" or "MASTER" in positions 41-46 of the header label. All tapes created by the CUPID program have this and if this message is printed the wrong tape is on drive #2. To restart mount the correct reel andpush start. To check the present tapes label again, push start.

"EOF MARK FOLLOWING HEADER LABEL MISSING. PUSH START TO TRY AGAIN"

The header label check has been completed but the header label is not followed by an end of file mark. The program will recheck the header label and test for the EOF is start is pushed.

The following stops have no messages printout because it would destroy the continuity of the printout.

This stop occurs when the input tape has been read 10 times in error. Pushing start allows the program to try 10 more times to correctly read the record.

This is a card reader end of file stop which occurs when there is still more data on the input tape but no subroutines in the card reader. To restart place the correct subroutine in the card reader and push start.

Tapes -

None

OUTPUT (CONTINUED)

COMERG

Documents -

A listing of all the components that are on the local tape but not on the master.

A listing of all "obsolete by" or "replaced by" part numbers.

Errata -

Messages -

"ENDICOTT TRAILER FOUND BUT NOT YOURS. WILL WRITE A TRAILER ON ON OUTPUT TAPE"

The master tape's trailer label was read but the local tape's trailer was not. The merge tape trailer will be written using the ENDICOTT trailer.

"TRAILER READ ON YOUR TAPE BUT NOT ON ENDICOTT TAPE. CHECK TAPES."

The local tape's trailer label was read but not the master's. The merge trailer will be written using the local trailer.

Halts -

"ENDICOTT HEADER INCORRECT. IT IS (Header Label)"
"MOUNT CORRECT TAPE AND PUSH START".

The master tape does not have the word "COMPONENTS" in positions 21-30 of the header label.

"REMOTE HEADER INCORRECT. IT IS (Reader label)"
"MOUNT CORRECT TAPE AND PUSH START".

The local component tape does not have the word "COMPONENTS" in the header label (positions 21-30).

".ENDICOTT EOF AFTER HEADER MISSING. PUSH START TO IGNORE".

The master tape does not have an end of file following its header label. If start is pushed the tape is backspaced and the program continues.

"REMOTE EOF AFTER HEADER MISSING. PUSH START TO IGNORE".

The local tape is missing on end of file following the header label. If start is pushed the tape is backspread and the program continues.

"THIS IS PART TYPE NOT VALID X"

OUTPUT (CONTINUED)

The part type specified by X is one the program cannot handle. This can occur only for the master tape. The program halts and there is no restart procedure.

"20 READ ERRORS DRIVE X. PUSH START TO TRY AGAIN".

The tape on drive X has been read 20 consecutive times with error. Pushing start will allow 20 more tries to read the tape.

"END OF FILE ON OUTPUT TAPE. RERUN JOB".

The merge tape is not physically long enough to contain the data and the job should be rerun with a larger reel on the output drive.

Tapes -

The merged CLT produced from COMERG will contain the following information:

1. All comp. on the master but not on the local.

2. All comp. on the local but not on the master.

3. All comp on the master that equal components on the local.

CLT FORMAT

File 1

80 character header label

File 2-20

1800 character component information records

File 21

80 character header label

SCOPE

Phase 1 is a system of 1401-7090 programs which accepts and checks transcribed circuit card data, provides errata and drawings, and produces an EDT.

INPUT

Phase 1 requires a layout of the circuit card on an appropriate grid sheet, the necessary records info., a CLT, a CHT for change runs, and an LMT.

Header Cards

Header cards contain detailed information to describe technical and records aspects of each card part number released or changed.

The information contained on these cards is designed to cover all possible variations of releases or changes through the CCDA system. Therefore, the total information required for a specific run is variable.

All information put on these cards should be packed left or started in the first column designated unless otherwise specified. Any change to the format described below may result in an error and may cause a delay in the release of a card.

R1 Card

Columns	Data
1,2	"R1"
3-9	Raw Card Part Number

This is the number of the basic card material, with or without an internal plane, with holes, lands, contacts, housing, and customizing.

Only one raw card part number per assembly may be used.

Five million series production part numbers controlled by Department 146, Endicott or experimental ("S") numbers supplied by the requesting circuits group must be used.

R1 Card (cont'd)

Columns	Data
	For the correct "S" number coding see DEP2-7047, Suffix 1, Section 6, Pg. 6. The second character distinguishes the raw card from the assembly part number. Use "2" for the raw card and "1" for the assembly.
12-17	Raw Card Engineering Change Level
	This number distinguishes each release and change from another. Each time the raw cards hole pattern, artwork, drawing and/or bill of material information is changed the E. C. level of the raw card must be changed.
	Formal E. C. numbers must be 6 numeric characters in length and preassigned by Department 146, Endicott.
	Development E. C. numbers must be 2 alphabetic and 4 numeric characters in length and assigned by Dept. 146. The following format must be used: DVnnnn.
	Experimental E. C. numbers will be assigned by the originating or packaging group. It is suggested that these numbers be 2 alphabetic and 4 numeric characters in length to be compatible with the other E. C. number formats. The suggested format, which the programs will check for, is EXnnnn.
18	Blank
19	Raw Card Engineering Change Level Code
	This one character code will be used to control the automated wet process line. It must be unique to each Raw Card Engineering Change Number of a card and should be equal to its card assembly E. C. code.
	Formal and Development Engineering Release numbers must be represented by their lowest order code. Each succeeding E. C. number must be represented by the next higher order code. Assignment of these codes is not retroactive. Therefore, if a card has been released and changed previously, the correct order code must be assigned and shown only after the E. C. number that is being processed.

R1 Card (cont'd)

Columns	Data

For Development E.C. number codes use "1" through "Ø".

For Formal E.C. number codes use "A" through "P", except for "I" and "O".

To determine the correct code for cards that have already been released or changed, count the previous Development or Formal E.C. numbers. Then assign as the code the corresponding number or letter of the alphabet.

Examples:

	E. C.	Code	E. C.	Code	E. C.	Code
Previous			DEV1234			
Previous			DEV1612			
Previous	DEV3142		160023		.	
Previous	DEV6191		163421		161234	
Processing	DV7231	3	167890	C	162076	B

20 — Original or Change Code

Use "O" for original and "C" for change. These codes indicate only the mode of computer processing.

Code "O" allows the computer to process the card as an original.

When code "C" is used, the computer searches its history files and replaces, deletes, and/or adds only the information input at this time. From the history and change information a new EDT of the card can be generated.

64-70 — Assembly Part Number

This is the card assembly part number. All information related to a card is referenced to this number on the CCDA history tape.

When making a change to a card, this reference assembly number must be called out.

For acceptable part number format see columns 3-9.

This number must be punched in these columns in each header card.

Columns	Data
73-78	Assembly Engineering Change Level

Each time the assembly drawing, assembly bill of material, or artwork changes, this level must be changed.

For the correct format see columns 12-17.

This number must be punched in these columns on each header card.

79	Blank
80	Assembly Engineering Change Level Code

This one character code will be used to control the automated card assembly line and represent the E.C. level of the card assembly on the housing. It must be unique to each card assembly Engineering Change number of a card and should be equal to its Raw Card E.C. code even though their E. C. numbers are equal.

For the correct format and use, see column 1[illegible]

This code must be punched in this column on each header card.

R2 Card

1,2	"R2"
3,6	Card Size

This is the size of the raw card being processed. Card sizes must be identified to the computer in the following form only.

3	4	5	6
1	-	6	
2	-	1	2
1	-	1	2
2	-	2	4
2	-	3	6
3	-	3	6
4	-	4	8

The number appearing in Column 3 indicates the card width or number of socket positions. The number appearing in columns 5 and 6 indicates the maximum number of SLT modules in standard positions on the card.

R2 Card (Cont'd)

Columns	Data
9-16	Material Drawing Number

This number specifies the material that the card should be built from, and must be called out each time a card is processed.

For cards with no internal planes, columns 9 and 10 must be left blank.

For cards with internal planes, column 9 must have an I and column 10 must have a P.

All cards that require no internal planes must call out:

9	10	11	12	13	14	15	16
		1	9	-	7	Ø	1

The standard voltage and ground planes are:

	9							16
1-12	I	P	8	1	1	Ø	7	1
2-24	I	P	8	1	1	Ø	7	2
2-36	I	P	8	1	1	7	2	5

The standard ground planes are:

	9							16
1-12	I	P	8	1	1	8	1	3
2-24	I	P	8	1	1	8	1	4
2-36	I	P	8	1	1	2	3	1

R2 Card (Cont'd)

Columns	Data
17, 18	Raw Card Status and Approval Code

The card status and approval code must be included each time a card is formal or development released and when the status and approval of the card changes.

The Status Code must be shown in column 17 using the following codes:

STATUS	CODE
ACTIVE	A
*OBSOLETE	O
*FIELD USE ONLY	F

The Approval Code must be shown in column 18 using the following codes:

APPROVAL	CODE
APPROVED	A
RESTRICTED	R

Approval Code Definition.

A. Approved - Satisfactory for use in all applications within the limits defined on the drawing and Engineering Specification.

B. Restricted Approved - Potentially satisfactory for IBM usage. Generally required when release is required prior to the completion of the evaluation of the release.

If any part of the assembly is restricted the assembly must be classified as restricted.

* For an explanation of these terms see Endicott GPD Engineering Procedure Manual, page number 2.2.44 and 2.2.45.

R3 Card

Columns	Data
1,2	"R3"
30	Front and Back Artwork Level Code

This must be a one digit numeric code and denotes whether or not the front and/or back artwork have had any changes made to them.

Each time an artwork part number is released this field must be blank. Each time an artwork is changed this code must be advanced to the next higher numeric level.
For example,

Release	(blank) 30
First change to artwork only	1 / 30
Second change to artwork only	2 / 30

L1 Card

Columns	Data
	This card determines how the hole pattern information, hole sizes and locations, will be generated by the computer.
	To allow greater accuracy in aligning artworks for the step and repeat procedure, the computer will automatically assign J hole-lands at XØ23-YØ23, XØ78-YØ23, on one wide cards; and XØ23-YØ23, XØ78-YØ23, and X148-YØ23 on two wide cards unless a hole is already present at these positions.
	If it is not possible to layout a card that would allow these hole-lands, each time the card is processed they must be deleted by using "P" Data cards.
	Since the hole pattern has been made part of the raw card, their part and E. C. numbers must always be the same. The computer programs will automatically place the raw card part and E. C. number in all hole pattern part and E. C locations.
1,2	"L1"
20	Original, Change, or History Code
	"O" and "C" are assigned automatically in this column depending on whether or not Columns 21-28 are filled in. If it is desired to pull the previous hole pattern from history and use it exactly as it existed before, an "H" must be placed in column 20.
21-28	Previous Hole Pattern Engineering Change Number and Code
	These columns must only be used when a hole pattern on history is going to be used or changed (adds or deletes).
	This E. C. number and code must agree with the E. C. number and code of the hole pattern that is on history. For the correct E. C. number and code formats see the R1 card, columns 12-19.

L1 Card (Cont'd)

Columns	Data
29-31	Automatic Hole Pattern

Each time a card is processed, YES or NO must be posted in these columns.

"YES" is used when automatic generation of all holes is required or changing a hole pattern on history. Manual overrides or additional holes can also be input in this made by entering the desired data on "P" cards.

"NO" is used when it is desired to manually specify all holes required, or use a hole pattern exactly as it exists on the hole pattern history tape.

W1 Card

1,2	"W1"
3-62	Assembly Drawing Title

This title must agree with the title on the ALD and schematic since all documents carry the same part number.

Because 30 characters will be printed out per line, proper care should be taken to divide the words of the title correctly.

W2 Card

1,2	"W2"
4-11	Previous Assembly Engineering Change Number and Code

This number and code must agree with the previous E. C. level and code of the assembly on the CHT.

For the correct E. C. number and code format see R1 Card, Columns 12-19.

W2 Card Cont'd

Columns	Data
12-15	Circuit Family and Speed

This code represents the circuit speed or class of the card. The available codes are 5N, 3ØN, 7ØØN, GEN or ANAL.

W3 Card

Columns	Data
1,2	"W3"
3-8	Assembly Packaging Specification

This specification number 890913 is required on all card assemblies and it will be automatically generated by the computer for the assembly drawing and assembly bill of material.

If the highest level of assembly in Endicott for a card is the raw card this specification number 890913 must be removed from the assembly drawing and assembly bill of material and put on the raw card bill of material. To do this place dollar signs ($) in columns 3-8 and enter 890913 as an "R" item on the HENGDESADSPEC card. Columns 3-8 must have dollar signs place in them each time a card of this type is processed through the computer.

Columns	Data
12,13	Assembly Status Approval Code

Enter the status code in column 12 and the approval code in column 13.

For the correct codes and usage, see the R2 Card, Columns 17, 18.

W3 Card (Cont'd)

Columns	Data
14-16	Circuit Approval Initials
17-22	Circuit Approval Date - see note on next page This is the date associated with the circuit approval initials in columns 14-16.

M1 Card

1,2	"M1"
3-14	Location - The originating location of the card must be placed in these columns. For example: Endicott, Poughkeepsie
15-42	Account Number

The following account number format must be used each time a card is processed. The release processing or records cost will be charged against this number.

Account number format.

Column	Number	Instructions
15-22	Order Reference	1. Pack right 2. Use leading zeroes 3. If there is no number use an "x" in each column.
23-26	Job	See Instructions 1, 2, 3, above.
27		
28-34	Account	See Instructions 1, 2, 3, above.
35-38	Appropriation number	See Instructions 1, 2, 3, above.
39	0	
40-42	Department	

M2 Card

Columns	Data
1,2	"M2"
3-14	Machine Type The IBM Machine Type for which the card is being released.
15-20	Quantity per Machine The quantity of cards assigned to the IBM Machine Type for which the card is being released. Not required for DV release or "S" numbers.
21-26	Quantity per six months The estimated first six months' usage of the card assembly for all machine types. Not required for Dev. release or "S" number cards.
27-32	Quantity per First Year or Model Cards The estimated first year's usage of the card assembly for all machine types - or the total number of model cards to be ordered.

M3 Card

1,2	"M3"
25-27	Designer's Initials
28-33	*Date Initialed by Designer
34-36	Detailer's Initials
37-42	*Date Initialed by Detailer
43-45	Checker's Initials
46-51	*Date Initialed by Checker
52-54	Approver's Initials
55-60	*Date Initialed by Approver

* Use the following 6 digit date code: January 4, 1963 equals Ø1Ø463. All 6 digits must be entered.

D Card

Columns	Data
1	"D"
2-7	Approximate date of release

To provide the same computer printed date on all documents released in a package or associate with a card, a prespecified approximate date of release must be specified on the "D" header card. This date will be associated with the current E. C. number and can be determined by adding 5 days to the minimum number of days it takes to make an EDT and ship it to Endicott. This date must never be later than the actual date of release.

In order to be able to distinguish between documents and EDT history that have the same E. C. it is necessary that all cards that are washed out and reprocessed under the same E. C. must have their approximate date of release updated.

HENGDESADSPEC Card

1-13 "HENGDESADSPEC"

This header card is used to input the raw card and assembly specification numbers that must be called out for each card to which they apply.

Each specification number must be preceded by its correct code. R for raw card, A for assembly. R specs will be placed on the raw card bill of material and A specs on the assembly bill of material.

All card and circuit specs that apply to a card must be input as "A" items.

When note AG is required A8118ØØ must be entered.

The spec numbers and alphabetic prefixes must be entered in the following columns:

16-23	Code and spec number
24-31	Code and spec number
32-39	Code and spec number

HENDESADSPEC CARD (CONT'D)

Columns	Data
40-47	Code and spec number
48-55	Code and spec number
56-63	Code and spec number

If it is necessary to call out more than six specification numbers which can be put on the HENGDESADSPEC card, change the A in column 8 to a B, C, D E, or F as more are required. This will allow a total number of 36 specification numbers so called out by means of these cards.

HAUTBOMVOLT Card

1-11 "HAUTBOMVOLT"

This card is used to input non-standard voltage pins so they will be called out on the assembly drawing.

The only condition under which the header should not be input is when any combination of the following standard voltage pins are used.

VOLTAGE	PIN
+3	D03, J03
-3	B06, G06
+6	B11, G11
GND	D08, J08

When one change or addition is made to the above voltages or one of the pins is used for a signal line all voltage pins must be entered.

16-18 Voltage Pin Identity

22-24
28-30
34-36
40-42
46-48
52-54
58-60

Each set of columns will be used to designate the pin identity of the voltages. Use the following format:

$\frac{D}{16}\ \emptyset\ \frac{7}{18}$ $\qquad$ $\frac{B}{22}\ 1\ \frac{3}{24}$

HAUTBOMVOLT CARD (CONT'D)

Columns	Data
19, 25, 31, 37, 43, 49 55, 61	Polarity These columns will be used to designate the polarity of each voltage. Use G for ground, + for positive, and - for negative. 1 for 12M.
20, 21 26, 27 32, 33 38, 39 44, 45 50, 51 56, 57 62, 63	Voltage The voltage values will be specified in these columns. Use the following format Ø6, 12, and ND for ground, 2M for 12M.

HAUTBOMDATA Card

1-11	"HAUTBOMDATA"
16-21	Sheet and Page Number of Assembly Drawing Column 16, 17 will be used to input the sheet number of the assembly drawing. Pack right and use leading zeroes when applicable. Column 18, 19 must contain "OF" Column 20, 21 will be used to input the total number of assembly package pages. Pack right and use leading zeroes when applicable. The order and contents of the assembly package is ALD, assembly drawing, and schematic.
41-48	Local Control Number This space has been set aside for use by the local packaging areas. This number will appear in the lower right hand corner of the Assembly drawing.

NOTE Card

Columns	Data
1	"N"
2,3	Note Code
4,5	Line Sequence Number or Delete Code

This number indicates the order and number of the punch cards that pertain to a note code. Use two character numeric numbers Ø1, Ø2, Ø3, etc.

To delete a note a "D" must be placed in column 4. Only columns 1-4 of one card need be filled out. It should also be kept in mind that if the code is called out on any components it must be deleted also.

6-14 Special Component Part Number

These columns are used to enter part numbers which appear in the body of the note and are required on the assembly or raw card bill of material. If more than one part number per note code is required, they must be entered on only the odd number line sequence cards.

When notes are called out automatically, because a note code is associated with a component library, whatever is in this field on the component library will be picked up and used on the card. If an "N" header is input, whatever is in this field on the "N" card will override this field on the component library. Use dollar signs ($) if no special component is required. When this note field is overridden, each time the card is processed the overriding input must be supplied.

15, 16 Unit of Measure of Special Components

Each note that specifies a special component must have a unit of measure entered.

This field will be taken from the component library unless overridden by "N" header input. Use dollar signs ($) if no unit of measure is required.

For definition of the available codes see the bottom of any tabulated bill of material. This type of bill is presently used in the SLT release package. When this note field is overridden, each time the card is processed the overriding input must be supplied.

Note Card (Cont'd)

Columns	Data
17,18	Quantity of Special Components

The total quantity of special components used per note code will be specified in these columns on the component library.

The computer will automatically calculate the total quantity of special components used on that card by multiplying the number of times the note code is used times the quantity field associated with the note in the library. If it is necessary to override the library or automatic calculation, the correct number must be entered on an "N" header. Use dollar signs ($) for blanks. When this note field is overridden, each time the card is processed the overriding input must be supplied.

Columns	Data
19-48	Verbal Description

For variable English field notes specify the body of the note in these columns.

Since 30 characters are entered on each "N" header and 60 characters are printed per line on each drawing, care should be taken to divide the words correctly.

On change runs all note and component information will be regenerated from the component library, except for variable English field notes. Therefore, if the special component, unit of measure, and/or quantity fields are overridden, each time the card is processed the overriding input must be supplied.

If a note code associated with a component part number in the library is overridden, the overriding note code will be used in the change runs.

All notes are controlled and issued by Department 146.

Note Card (Cont'd)

It is very important that all notes be used properly and called out when a component requires them. No asterisks may be used in notes.

The majority of notes are standard and specified in the CLT printouts.

Notes can be called out in several ways:

1. If a note code is specified after a component part number on the grid sheet, the note code should be posted in the appropriate columns of the transcription sheet and the computer will print out the note code with the component in the body of the drawing and the body of the note on the side of the drawing.

2. Note codes that are associated with components in the library will be printed out automatically on the drawing.

3. Standard notes that are required on the Raw Card - Hole Pattern drawings must be called out by filling out columns 1/5 of a "N" header card.

4. Note codes followed by three asterisks on the library printout are variable English field notes or notes that must have their verbal description, special component part numbers, unit of measure, and quantity specified each time the note is called out on an original run or when any part of the information is changed. The following formats must be used for each variable English field note.

AJ - NO SOLDER IN HOLES LOCATED AT (THEN LIST X AND Y COORDINATES)

X and Y coordinates may be listed in the following ways:

1. X111 Y111 = X111Y111,etc.
2. X111 Y111 = 111 = 111 = X111Y111 = 111 =111 etc.
3. Y111 X111 = 111 = 111 = Y111X111 = 111, etc.

This note should not be used unless approval is first obtained from Department 146.

NOTE CARD (CONT'D)

AZ The format for this note will be given each time it is required. This note must not be used unless approval has been obtained from Dept. 146.

BA This is a hole pattern note used to call out odd size plated through holes on grid.

DRILL (Size of Hole) (Tolerance) BEFORE PLATING AT LOCATIONS (X,Y Coordinates).

BB This is a hole pattern note used to call out odd size non-plated through holes on grid.

CX This note will be used for special raw card requirements. Approval from Dept. 146 must be obtained before this note is used.

CY This note will be used for special requirements regarding housing and/or contacts.

CZ This note will be used when the Photo Lab is required to perform a special operation on an artwork. Approval from Dept. 146 must be obtained before this note is used.

FZ Whenever special heatsink assemblies are required this note must be used to describe how to assemble them and call out any special components required with them.

HAUTBOMECN Card

The following format and example describes the method of listing the Engineering Change number and code history on the assembly drawing.

This listing is required for cards that have been released manually or changes that are being processed as originals through the D/A programs.

Columns	Data
1-10	"HAUTBOMECN"
14,15	Eight times the number of E. C. numbers entered on the punch card not including columns 73-80 must be posted in these columns.
16-23	E. C. Number and Code History Listing
24-31	
32-39	List the most recently processed E. C. number first
40-47	
48-55	

HAUTBOMECN CARD (CONT'T)

Columns	Data
16-23 24-31 32-39 40-47 48-55	E. C. Number and Code History Listing List the most recently processed E. C. number first.

HAUTBOMDATE CARD
Use this card to list the dates of the corresponding E. C. numbers described under the HAUTBOMECN CARD.

1-11	HAUTBOMDATE CARD
14, 15	Six times the number of dates entered on the punch card must be posted in these columns.
16-21 22-27 28-33 34-39 40-45	Date History List the dates that correspond to the E. C. numbers on the HAUTBOMECN Card.

Example of HAUTBOMECN and HAUTBOMDATE Card.

5803030 was released on DEV 1200-10/1/63 and changed on DEV 1300-11/1/63, DEV 1400-12/1/63, and is now being changed on DV1500 4-2/1/64:

H A U T B O M E C N (1–10) - - - 2 4 (14, 15) D E V 1 4 Ø Ø (16–23)

D E V 1 3 Ø Ø (24–31)

D E V 1 2 Ø Ø (32–39)

(40) - - - - - - - (47)

(48) - - - - - - - (55)

5 8 Ø 3 Ø 3 Ø (64–70)

D V 1 5 Ø Ø _ 4 (73–80)

HAUTBOMDATE CARD (CONT'D)

H A U T B O M D A T E _ _ 1 8 1 2 Ø 1 6 3
(1) (11) (14) (15) (16) (21)

1 1 Ø 1 6 3
(22) (27)

1 Ø Ø 1 6 3
(28) (33)

34 - - - - 39

40 - - - - 45

5 8 Ø 3 Ø 3 Ø
(64) (70)

D V 1 5 Ø Ø _ _ 4
(73) (80)

Assembly Part Number Change Card

The following format may be used to change assembly part numbers of cards on history.

This card must be placed in front of the R1 card before processing.

All other part numbers and information concerning the card can then be changed. The previous assembly E. C. number on the W2 card must be the same as the E. C. number of the previous assembly part number.

Columns	Data
1	"-"
2-7	"CHANGE"
9,10	"PN"
12-18	OLD PART NUMBER
22,23	"TO"
25,26	"PN"
28-34	NEW PART NUMBER

HLOG Card - is used to input a four digit number, which corresponds to the ALD log number, for controlling the internal processing of the CCDA information and the ALD. The HLOG and ALD log numbers are printed on-line by ALDCOP 2. The program does not check these numbers. If the E. C. numbers match, the ALD will be placed on the EDT.

Columns	Data
1-4	"HLOG"
6-11	"NUMBER"
16-19	Any four digit number - should correspond to ALD log number.

ENGINEERING DATA KEY PUNCH

ENGINEERING DATA	KEY PUNCH
Raw Card Part Number	R 1 / 1 2 3 - - - - - - 9
Raw Card E. C. #,--Code--O or C	12 - - - - 17 19 20
Assembly Part Number	64 - - - - - 70
Assembly E. C. # and Code	73 - - - - 78 80
Card Size	R 2 / 1 2 3 - - 6
Material Drawing #	9 - - - - - - 16
Raw Card Status	17 18
Artwork Level	R 3 / 1 2 30
"H" if use as is	L 1 / 1 2 20
Hole Pattern Prev. E. C.#-Code	21 - - - - - - 28
Auto Hole Pattern <u>YES</u> or <u>NO</u>	29 - 31

ASSEMBLY TITLE

First Line on Asm. Drawing	W 1 / 1 2 3 - 32
Second Line on Asm. Drawing	33 - 62

Field	Card Columns
	W 2 1 2
Previous Asm. E. C.#-Code	4 - - - - - - - 11
Circuit Family	12 - - 15
Asm. Status	W 3 1 2 12 13
CKT. Appro. Initials	14 - 16
CKT. Appro. Date	17 - - - - 22
Location	M 1 1 2 3 - - - - - - - - - - - 14
Account #	15 - 42
Machine Type	M 2 1 2 3 - - - - - - - - - - - 14
Quantity/Machine	15 - - - - 20
Quantity/6 Months	21 - - - - 26
Quantity/1st Year or Model Cards Required	27 - - - - 32

PHASE 1 SECTION 5

M 3
1 2

Designer's Initials and Date
25 – 27 28 – – – – 33

Detailer's Initials and Date
34 – 36 37 – – – – 42

Checker's Initials and Date
43 – 45 46 – – – – 51

Approver's Initials and Date
52 – 54 55 – – – – 60

Approx. Date of Release D
1 2 – – – – 7

H E N G D E S _ D S P E C
1 2 – – – – 7 8 – – – – 13

Spec. #
16 – – – – – – 23

Spec. #
24 – – – – – – 31

Spec. #
32 – – – – – – 39

Spec. #
40 – – – – – – 47

Spec. #
48 – – – – – – 55

Spec. #
56 – – – – – – 63

H A U T B O M D A T A
1 – – – – – – – – – 11

Sheet Numbering
16 – O F – 21

L. C. N.
41 – – – – – – 48

H L O G _ N U M B E R
1 – – 4 – 6 – – – – 11

Log Number
16 – – 19

H A U T B O M V O L T
1 11

Pin Identity 16 — 18 Polarity 19 Voltage 20 21

22 — 24 25 26 27

28 — 30 31 32 33

34 — 36 37 38 39

40 — 42 43 44 45

46 — 48 49 50 51

52 — 54 55 56 57

58 — 60 61 62 63

NOTES

Note Reference N 1 2 3 Line Sequence 4 5

Special Component # 6 — — — — — — — — 14 U/M 15 16 Qty. Used 17 18

NOTES

Note Reference N 1 2 3 Line Sequence 4 5

Special Component # 6 — — — — — — — — 14 U/M 15 16 Qty. Used 17 18

NOTES

Note Reference N 1 2 3 Line Sequence 4 5

Special Component # 6 — — — — — — — — 14 U/M 15 16 Qty. Used 17 1

H A U T B O M E C N
1 ... 10

Number of E.C. on this card (times 8)

14 15 E.C.

16 — — — — — — 23

24 — — — — — — 31

32 — — — — — — 39

40 — — — — — — 47

48 — — — — — — 55

H A U T B O M D A T E
1 ... 11

Number of dates on this card (times 6)

— — Date

16 — — — — 21

22 — — — — 27

28 — — — — 33

34 — — — — 39

40 — — — — 45

HEADER FOR CHANGING ASM. PART NUMBERS

- C H A N G E _ P N
1 ... 10

(Old P/N)

12 — — — — — 18

T O _ P N
22 ... 26

(New P/N)

28 — — — — — 34

This card is placed in front of the R1 Header before running.

DA Input Aids and Requirements

CONTACTS

Presently the DA programs automatically generate note CE and calculate the number of contacts having printed circuit lines connected to them. In the near future the programs will be changed to call out a full complement of contacts on each card, since it has been decided to build SLT cards with all contacts inserted. Card releases do not need to reflect this change until the programs are installed. If approval has been obtained to alter the quantity of contacts, note CE must be entered on a "N" header card specifying the correct quantity or deleting it each time the small card is processed. Note CY will be used to spec fy the special requirements. If more than 100 separate holes are added in one run note CE must be entered manually.

HOUSING

For each card processed, note CC or CD will automatically be generated by the computer.

If approval has been obtained not to call out a housing, the appropriate note should be deleted on a N header card each time the small card is processed. Note CY will be used to specify the special requirements.

For single socket position cards use CC.

For double socket position cards use CD.

C. C. D. A. CHANGE PROCESSING

When the card was released through DA before and is on history.

A. If the change only requires a few adds and/or deletes, it should be processed as a change run. The following information is required:

1. A completed R1 card with a "C" in column 20.
2. The card size on the R2 Card.
3. A completed L1 card.
4. A "D" Header card.
5. The previous assembly EC number in columns 4-11 of the W2 Card
6. Any additional information or changes must also be input on the header cards.

7. If a field is not being used which was used on the original run and it is not desired on the EDT, a $ should be put in that field. The only exceptions to this rule are columns 64-80 of each header card, columns 4-11 on the W2 card, and N headers. A note is changed by adding it correctly or calling out the corrected note from the library.

B. If the change is extensive and it would be unfeasible to process all the adds and deletes, the card may be run as an original.

If this mode of processing is used, the card will be considered as an original and information on history will be completely erased and replaced by the new information; therefore, it is necessary to completely re-input the card. Since all history is lost, no EC listing will appear on the assembly drawings; therefore, the HAUTBOMECN and HAUTBOMDATE cards must be used to list the previous EC levels on the assembly drawing.

When the card was processed manually.

A. Since the card has never been processed through the computer, it must be handled as an original run. The HAUTBOMECN and HAUTBOMDATE cards must be used to list the previous EC levels on the assembly drawing.

DECOUPLING

Every card processed must call out either note AG, AH, AK or AL

AG Card conforms to decoupling requirements in 811800.
AH Card does not conform to decoupling requirements in 811800.
AK Card has been decoupled. 811800 is not applicable.
AL Card has not been decoupled. 811800 is not applicable.

AG and AH must be used when 811800 is applicable.

AK should be used where the requestor has specified decoupling for discrete component cards, cards with a mixture of discrete components and modules and the cards which are not covered by 811800.

AL should be used for all other appropriate cases.

COMPONENT NUMBERING

All components that appear within the outline of the card on the assembly drawing will be automatically numbered by the computer each time the card is processed. Components will be numbered in order beginning with the highest X-Y coordinate transcribed for each component.
All components must reflect this numbering on the schematic.

Data Cards

Automated Coordinate Conversion (ACC) - a method of transcribing circuit card data (wires, holes, lands, and components). Several methods of coding are used. These methods use combinations of the "X" and "Y" coordinates plus an alphameric cross reference of all standard hole locations. For hole locations and intersections the "X" coordinate is always transcribed first.

The format of columns 1-15 is the same for wire net, component (except M and B type components with non-numeric lead codes), and hole cards. Front and back artwork, hole, and component information should not be transcribed on the same punch card.

Commas are used to separate nets, component leads, hole-lands, and precede transcription from an intersection on each punch card. Do not use commas to separate transcription from one card to another or to end a card.

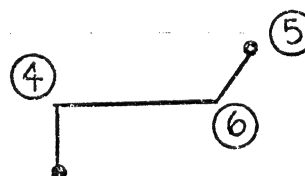
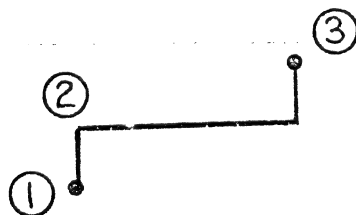
If the transcription of a net or component extends beyond one card it must be terminated at a logical point, for example, a tab, hole-land, or asterisked intersection point. This logical point must be repeated on the next card.

It is hoped that the following explanation will be an aid in transcribing. It attempts to explain how the program operates.

After transcribing a point (1), the program needs another point (2), to proceed toward. Point (2) also indicates direction. The shortest route is taken between 1 and 2. The program then follows the channel called out by point (2) in the direction of the next transcribed point (3). After reaching the perpendicular channel called out by point (3) the program moves in that channel to the next point; unless point (3) is a hole-land, then it goes to that hole-land.

When a 45° line is called for the program will move from the point (4) it is at on a 45° angle, if possible, to the next point (5). If a 45° angle is not possible from the point (4) it is at to the next point (5), it will move in the direction of the next point in the channel defined by the point (4) it is at until it comes to the first point (6) a 45° line can be transcribed from; then it will go from that point (6) at a 45° angle to the next point (5).

(1) (2) (3)
A1A1-Y26-B1B1

(4) (5)
A1A1-Y26/-B1B1

Columns	Data
1-7	Assembly Part Number - See columns 64-70 of the R1 header card for an explanation.
12-14	ACC Data Card Sequence Number or E. C. Number The cards in the input deck can be numbered using this field. This will be an aid when trying to locate cards in the deck when making corrections. An E. C. number can also be placed in this field, if desired, for control purposes. This field does not have to be used.
15	Delete Code - On change runs a "D" is placed in this column to delete the wire nets, components, or holes listed on this punch card.
16	Wire Side Code

Code	Wire Side
0	Front Artwork
B	Back Artwork

17 Wire Size Code -

Code	Wire Size
A	.031 line (offset)
B	.013 line
C	.013 line (offset)
D	.031 corner line
E	.031 " "
F	.031 " "
G	.031

Columns	Data
18-79	Wire Nets- Use the following formats when coding:

a. X25, Y37, X131, Y159, etc. to represent all channel points that wires segments run to and from.

b. A1B1, C1D1, Z1H1, etc. to represent standard hole-land locations.

c. Ø23Ø35, Ø37Ø42, etc. to represent all non-standard or standard hole-land locations. The "X" coordinate must be transcribed first.

d. Ø25Ø31*, Ø31Ø61*, etc. to represent an intersection point that has been returned to transcribe the rest of the net. The "X" coordinate must be transcribed first.

Wire nets are transcribed by starting at a tab or hole-land location; followed by a dash (-), a series of "X" and "Y" channels, and ending at a hole-land or tab. The only exception to starting and ending at a hole-land or tab is when an intersection is being transcribed to or from a hole land or tab.

a. If a net continues after hitting a hole-land follow it by a dash (-) and start the new subnet.

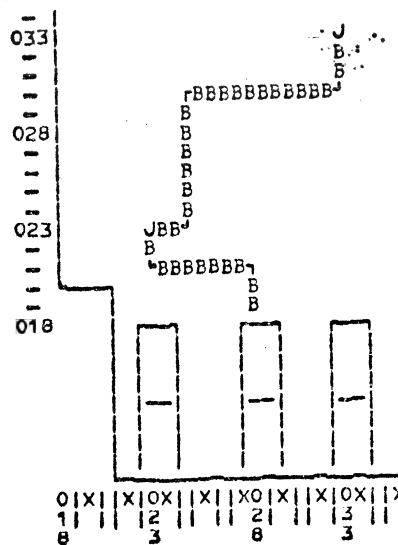
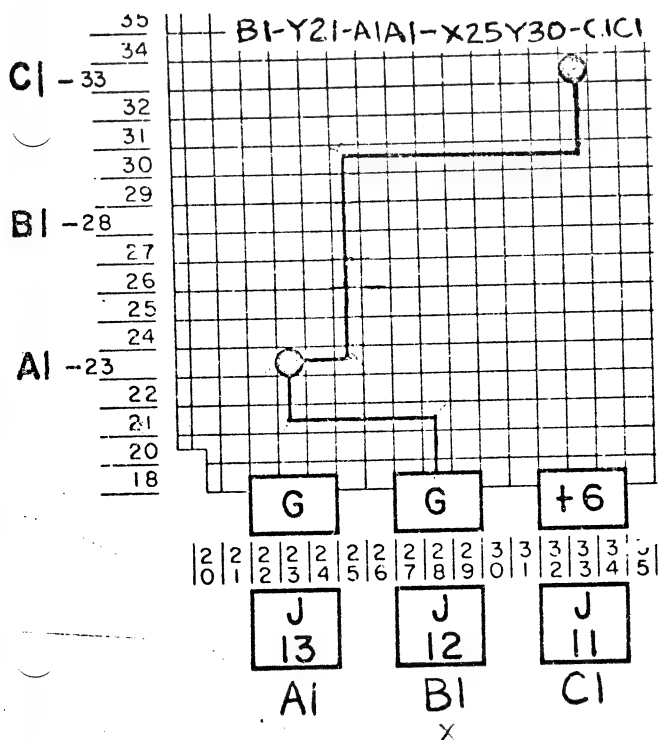
5808119166227 BBB1-Y21-A1A1-X25Y30-C1C1

B1-Y21-A1A1-X25Y30-C1C1

C1 - 33
B1 - 28
A1 - 23

G G +6

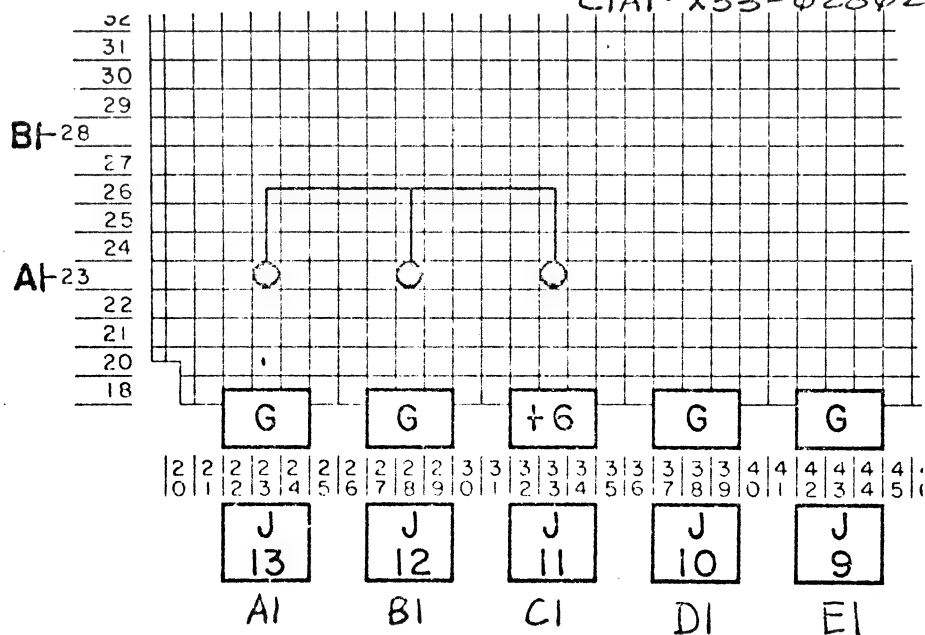
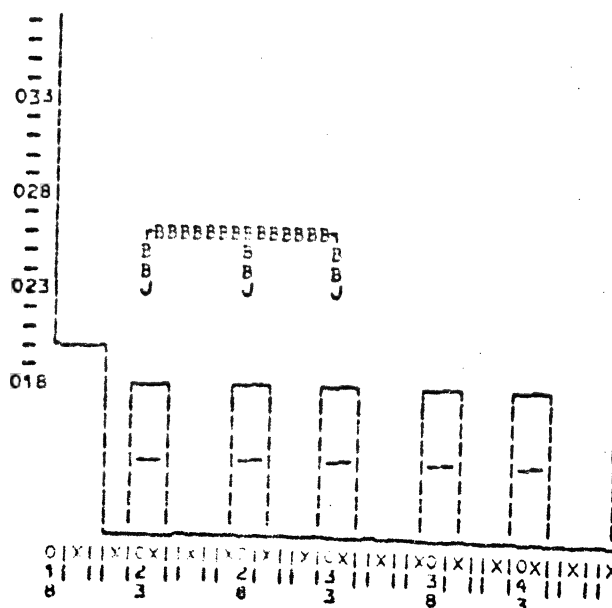
J 13 A1 | J 12 B1 | J 11 C1

b. Two hole-lands connected by a straight line are coded as follows:

5808119166227 BBE1-E1A1,E1B1-F1C1,G1A1-H1A1,053028-058028,056034-062034

c. At any intersection, the transcription must not continue straight, a turn must be transcribed. The programs will flag incorrectly transcribed nets. These must be corrected before the EDT is released to the Endicott CCRP system. Methods of transcribing a net with an intersection are:

1. Reflect a turn in the transcription at the intersection and continue on to a hole-land or tab followed by a dash (-). Transcribe the other sub-net(s) even though some segments are duplicated. If duplicate segment are transcribed the ACC or RDTRAN program will delete them.

2. To eliminate duplicate segments, code by an intersection, refecting a turn in the transcription to a hole-land or tab followed by a comma (,). Return to the intersection and code the three character numeric "X" then the "Y" coordinate followed by an asterisk (*), a dash (-) and the rest of the net.

A1A1-Y26 -B1A1, Ø28Ø26*-X33-C1A1
OR
C1A1-X33-Ø28Ø26*

5808121166227 BBA1A1-Y26-B1A1,028026*-X33-C1A1

Data

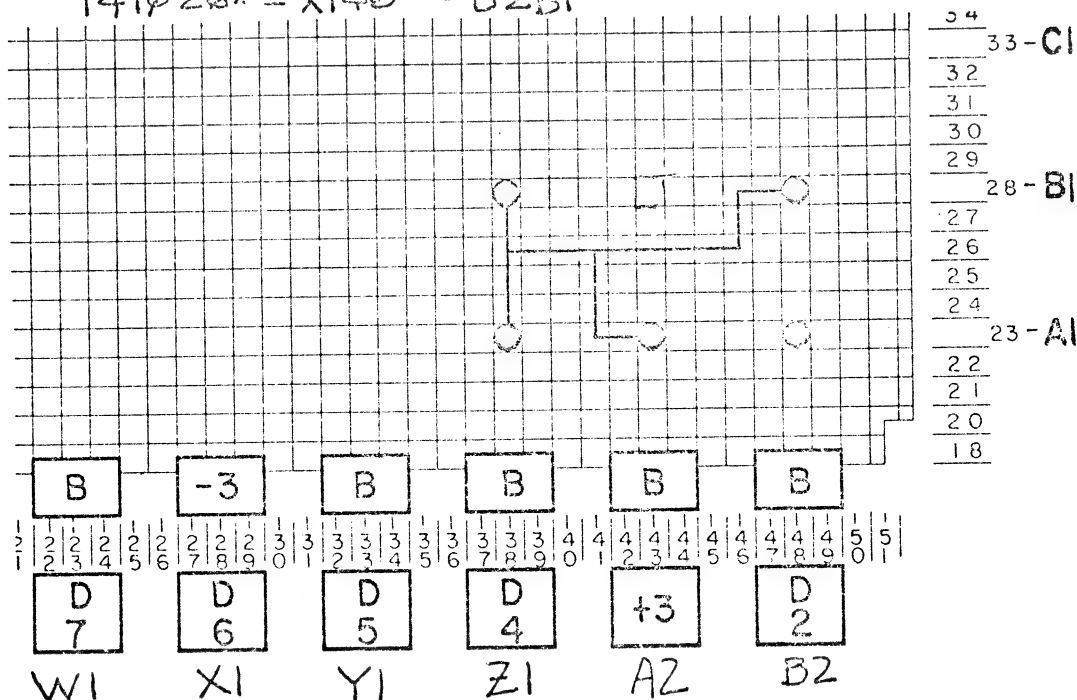
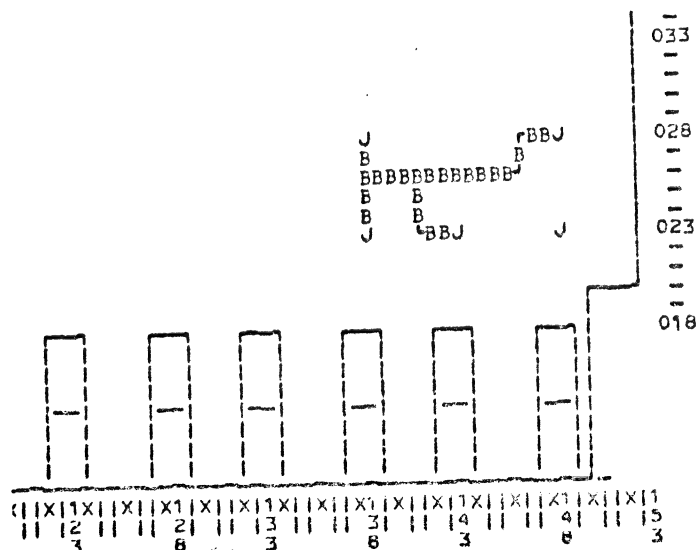
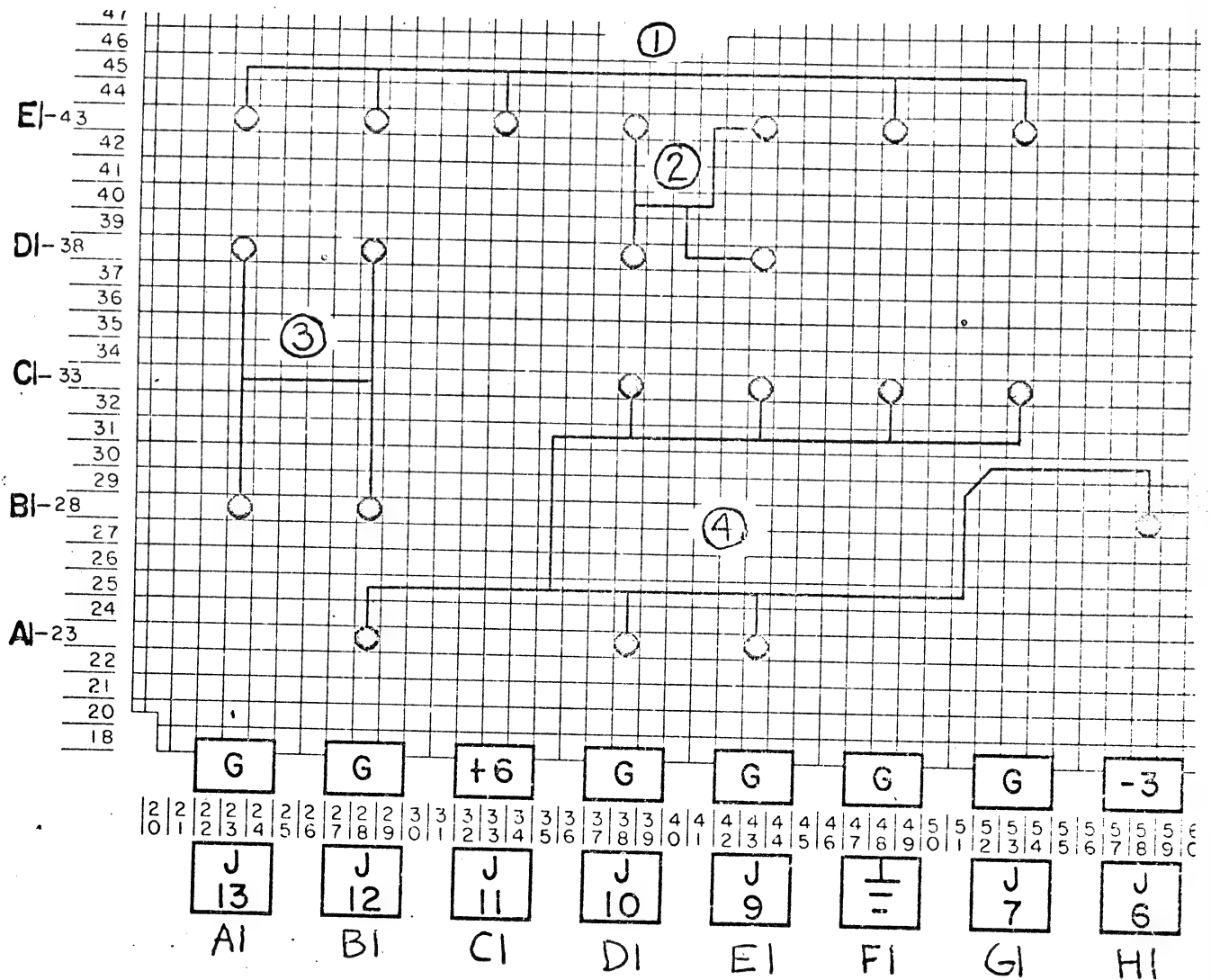
d. If a net is made up of several intersections, separate each subnet coded from the intersections by a comma (,).

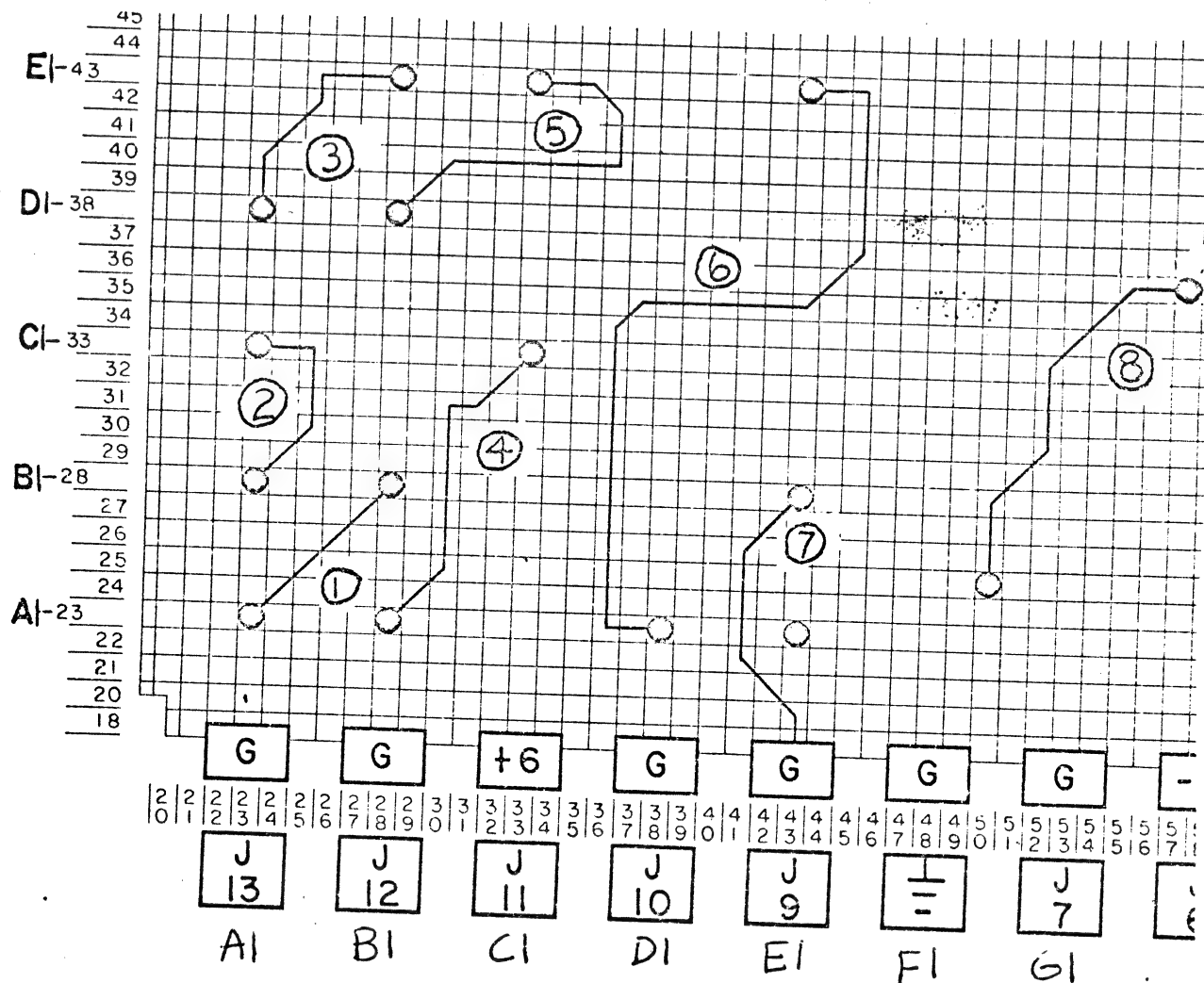
Z1B1-Y26X141-A2A1, 138Ø26*-Z1A1,
141Ø26*-X146 -B2B1

33-C1

28-B1

23-A1

W1 X1 Y1 Z1 A2 B2

5808121166227 BBZ1B1-Y26X141-A2A1,138026*-Z1A1,141026*-X146-B2B1

TRANSCRIBING LINE INTERSECTIONS

1. A1E1- Y45- B1E1- Y45- C1E1- Y45- F1E1- Y45- G1E1
2. E1D1- X4ØY4Ø- D1D1, D1E1- Ø38Ø4Ø*, Ø4ØØ4Ø*- X41-E1E1
3. A1B1- Y33X28- B1B1, A1D1- Ø23Ø33*, Ø28Ø33*-B1D1
4. B1A1- Y25X35Y3Ø-D1C1-Y3Ø- E1C1-Y3Ø- F1C1- Y30-G1C1
   Ø35Ø25*- X38- D1A1- Y25- E1A1- Y25X51/29Y3Ø- H1B1

e. A slash (/) is used to indicate a 45° line. 5 different ways are used to transcribe 45° lines. They are illustrated in the following example

(1) A1A1- B1B1

(2) A1B1- /X25-A1C1

(3) A1D1- Y4Ø/23X25-B1E1

(4) B1A1- /X3ØY31/- C1C1

(5) B1D1- /X3ØY4ØX36/42X35- C1E1

(6) D1A1- X36/34Y35/43X45-E1E1

(7) E1- Y2Ø/43X41/-E1B1

(8) Ø5ØØ25-Y28/5ØX52/33Y36-Ø57Ø36

Components

Column	Data
16	Component Code - "G"
17	Component Type Code - Usually posted in front of the component part number in the grid sheet.

C - Capacitor	T - Transistor
P - Potentiometer	S - Heat Sink
D - Diode	J - Jumper
L - Inductor	U - Program Cap
H - Core	Y - Delay line
M - Module	A - Crystal
R - Resistor	B - R/C Pac
X - Pulse Transformer	I - Reed Relay
Q - Special Component	G - Monolithic Module

18-25 — Component Part Number - Pack left. Found adjacent to the component representation on the grid sheet.

26,27 — Note Code - The note code required with the picture of the component on the assembly drawing. This code should be posted immediately following the component part number on the grid sheet.

28-79 — Component Lead Data - Components are transcribed by specifying the lead insertion holes of all the components' leads. Each lead entry is separated by a comma. If a lead requires a code the lead's coordinate must be followed by a slash and then the code. The codes for only two leads need be entered.

a. Modules (M) and R/C Pacs (B) - with numeric lead codes only, need only the number of leads and the three numeric digit "X" and "Y" coordinates of leads Ø1 and Ø2 entered. Do not separate the lead entries by a comma.

For modules and R/C pacs with non-numeric (1X, Ø+, etc.) lead codes a segment between each lead must be transcribed using the following format. Use one card for each segment.

Column	Data
1	"G"
2	Change Code A - Add D - Delete
5	"G"
6,7	Lead Code at From Terminal - need only be defined once per lead.
8-10	"X" Coordinate at From Terminal
11-13	"Y" Coordinate at From Terminal
15-26	Component Type Code and Part Number - pack left. This field must be filled in on only one card per component.
27,28	Note Code - This field must be filled in on only one card per component when required.
29	"G"
30,31	Lead Code at To Terminal - need only be defined once per lead.
32-34	"X" Coordinate at To Terminal
35-37	"Y" Coordinate at To Terminal
64-70	Card Assembly Part Number
73-80	Card Assembly E.C. and Code

*—23—48—5—R—1——43 *

+—48—48—1—C—1——68 *

01 2X 3X 4X 43 43 05 6CR 1

01 50 40 02 03 04 65 40 3 A 2

07 23 38 08 09 10

06 11

05 12

04 03 02 38 23 01 7 2 1

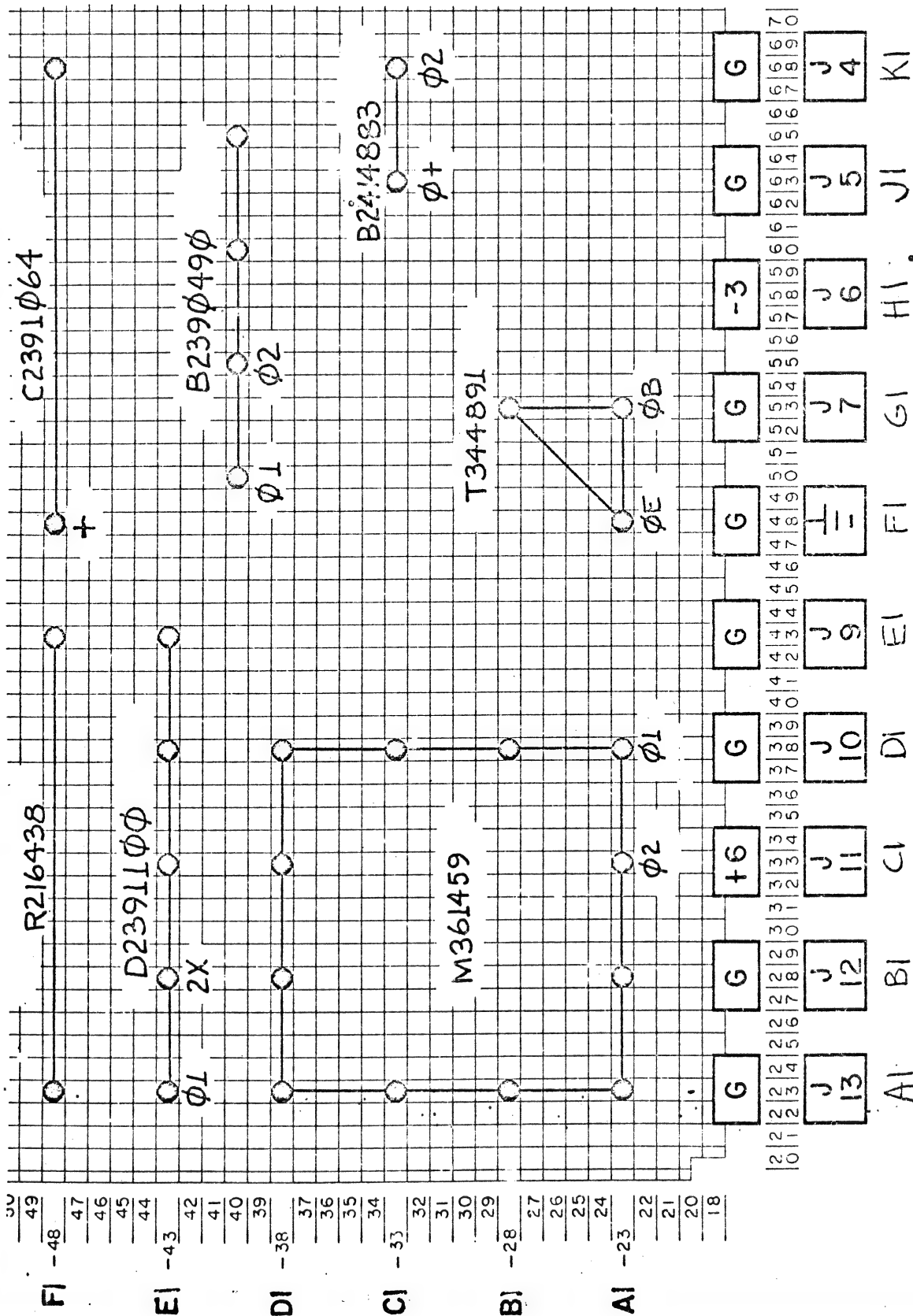
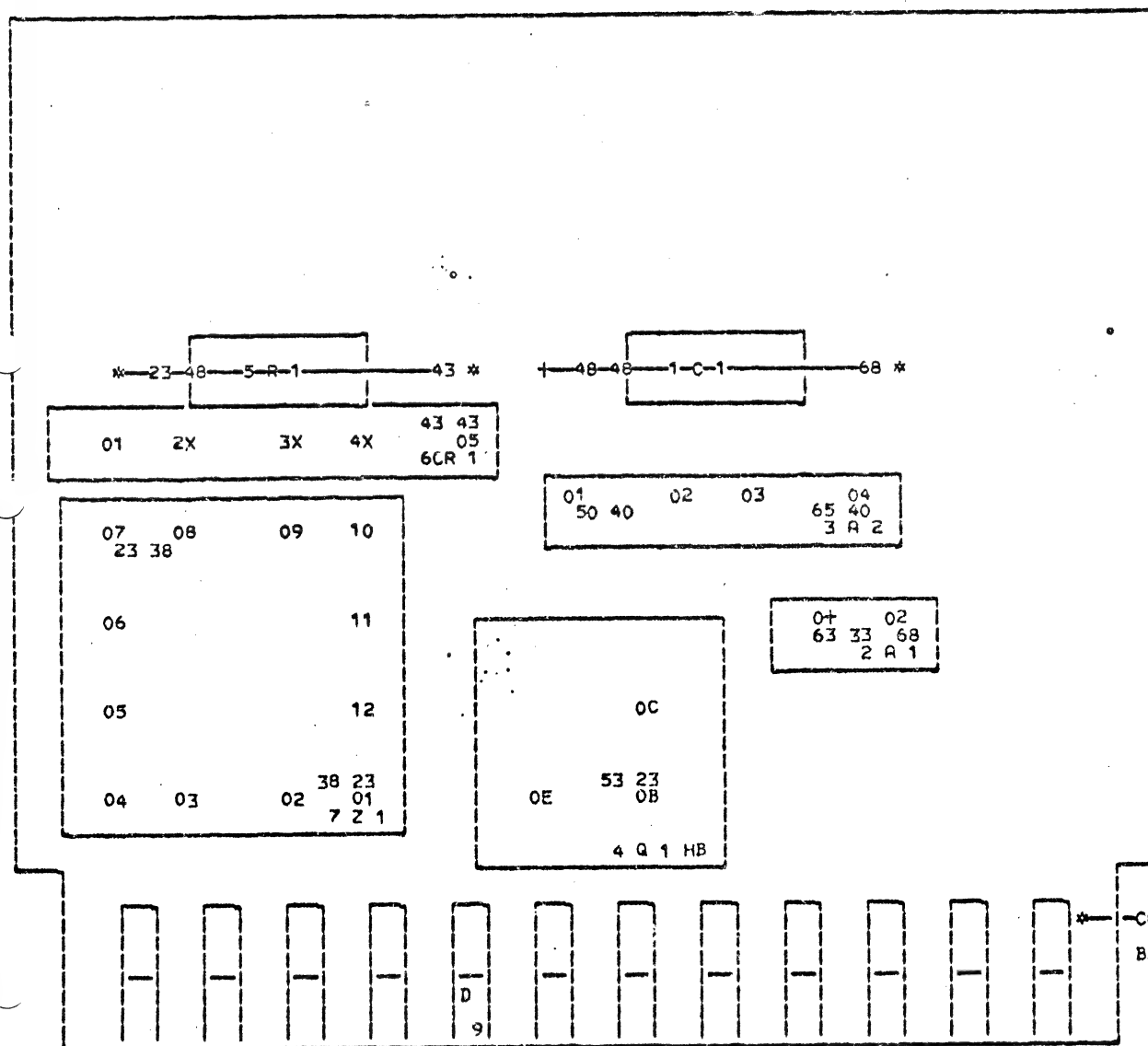
0+ 63 33 02 68 2 A 1

0C

0E 53 23 0B

4 Q 1 HB

D 9

*—CONTACTS ON BACK OF CARD

5808123166227 GM361459 12038023033023

5808123166227 GD2391100 A1E1/01,B1E1/2X,C1E1,D1E1,E1E1

5808123166227 GR216438 A1F1,E1F1

5808123166227 GT344891 G1A1/0B,F1A1/0E,G1B1

5808123166227 GB2390490 04050040055040

5808123166227 GC2391064 F1F1/+,K1F1

GA G0+063033 B2414883 G02068033

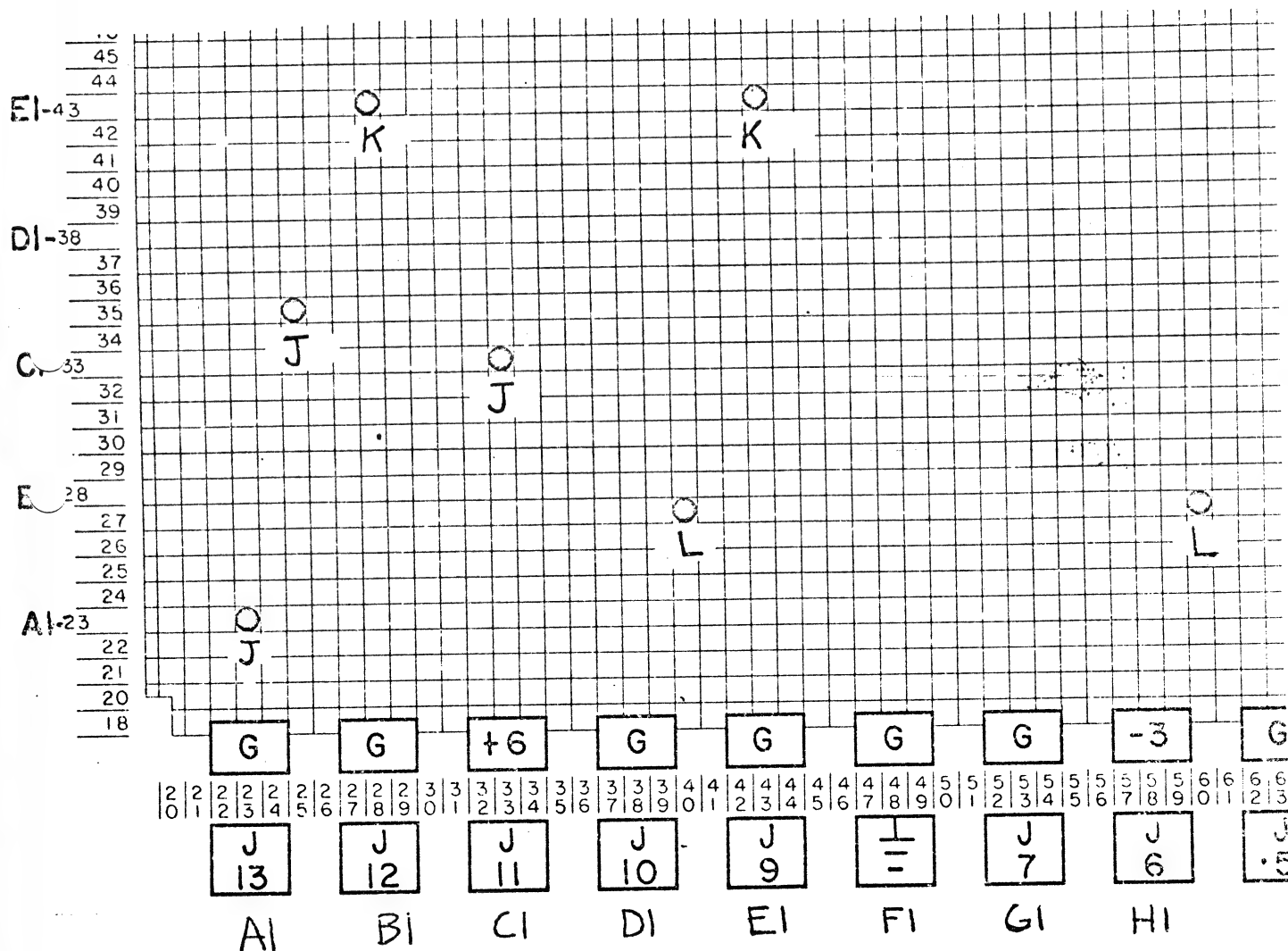
Special Holes -

Column	Data
16	"P"
17	Hole-Land Size Code
18-79	Hole-Land location - the numeric "X" and "Y" coordinates and/or the alphameric code for the desired hole-land locations. Each entry must be separated by a comma.

E1-43
D1-38
C1-33
B1-28
A1-23

G G +6 G G G G -3 G

J 13 J 12 J 11 J 10 J 9 J 7 J 6 J 5

A1 B1 C1 D1 E1 F1 G1 H1

JA1B1, Ø25Ø35, C1C1

KB1E1, E1E1

LØ4ØØ27, Ø6ØØ27

K K

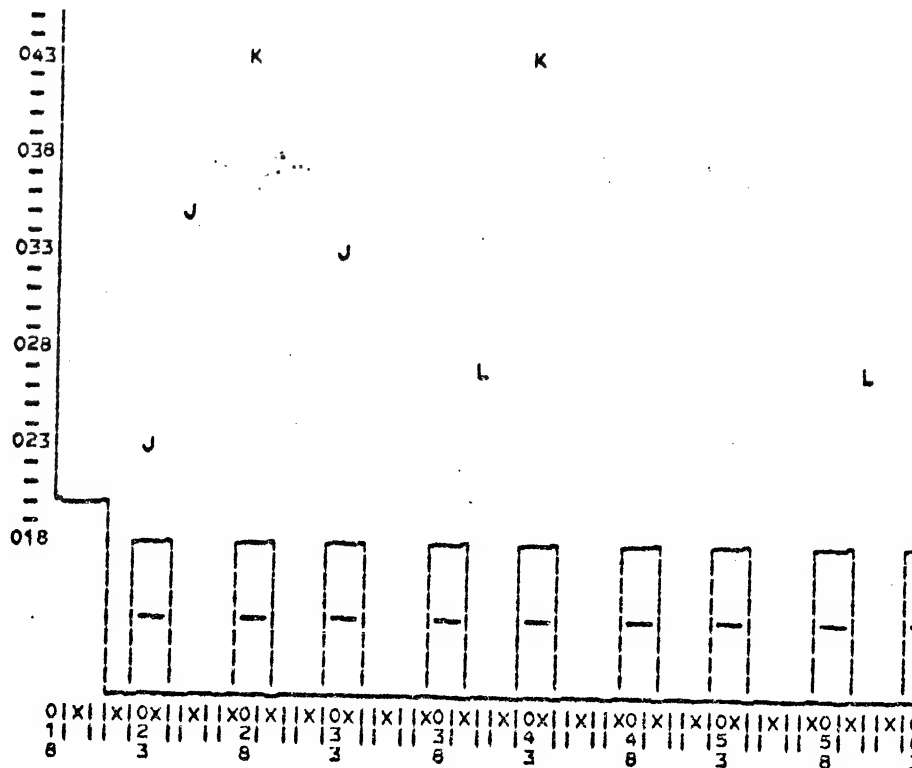
J

J

L L

J

043 038 033 028 023 018

0 1 8 | X | | X | 0X 2 3 | X | | X0 2 8 | X | | X | 0X 3 3 | X | | X0 3 8 | X | | X | 0X 4 3 | X | | X0 4 8 | X | | X | 0X 5 3 | X | | X0 5 8 | X | | X | 0 6 3

5801234163210 PJA1B1,025035,C1C1
5801234163210 PKB1E1,E1E1
5801234163210 PL040027,060027

Alternate and/or Small Change Method of Transcription- uses the following format and does not require the ACC program to be run. Individual wire segment can be added and deleted using this method.

Wires and Components

Column	Data
1	Component or Artwork Code G - Components O - Front Artwork B - Back Artwork
2	Change Code A - Add D - Delete
5	From Hole-Land Code - This column is filled in only when a hole-land is required at the "from" point for the data being transcribed. Code / Data G - Components O - Front Artwork B - Back Artwork
6,7	Lead Code at From Terminal - components only
8-10	"X" Coordinate at From Point
11-13	"Y" Coordinate at From Point
14	Wire Size Code
15-26	Component Part Number - pack left, components only
27-28	Note Code - components only
29	To Hole-Land Code - See column 5
30-31	Lead Code at To Terminal - components only
32-34	"X" Coordinate at To Point

Column	Data
35-37	"Y" Coordinate at To Point
64-70	Card Assembly Part Number
73-80	Card Assembly E.C. and Code

Hole - Lands - only one hole-land can be entered per card

Column	Data
1	"P"
2	Change Code A - Add D - Delete
3	Hole Size Code
4	Front Land Size Code
5	Back Land Size Code
8-10	"X" Coordinate of hole-land
11-13	"Y" Coordinate of hole-land
64-70	Card Assembly Part Number
73-80	Card Assembly E.C. and Code

DELETENET CARDS

For each side of the same cards a card RDTRAN assigns net numbers to common wire segments. By specifying the desired net number all of the segments in that net will automatically be deleted by the programs.

The net numbers are determined by printing the desired part numbers from the CHT with the LIDUMP program. The net number is then determined by locating a wire segment in the net it is desired to delete.

Up to 50 nets can be deleted per run.

The card format is:

Column	Data
1	"-"
2-10	"DELETENET"
11-63	Net numbers - net numbers separated by commas or blanks. A comma must not follow the last net number on the card.

Column	Data
64-70	Assembly Part Number
73-80	Assembly E. C. Number and Code

These cards must be inserted in the input deck immediately following the R2 header card.

1401 Programs

TX- is the 1401 program that changes the format of the input from that of the X-Y machine to a format readable by the FORMIT system of programs. When it is given the first two leads of of a 12 or 16 leaded module, the program calculates the remaining leads. If given the first lead code for any component, the program assigns the remaining lead codes.

ACC - program accepts punched card input which represents the wire segments, components, holes, and headers. It checks illegal slopes, invalid coordinates and generates a tape containing detailed X, Y coordinates for further processing by the FORMIT system.

FORMIT, SHAPIT, MERGN, GANUP and OUTPIT are a system of programs that are normally run in series. FORMIT edits and checks header cards and translates them into a format that is used by subsequent CCDA programs. It also checks for legal wire, land and tab codes.

SHAPIT - reworks component data and notes and pulls data off the card history tape on change runs.

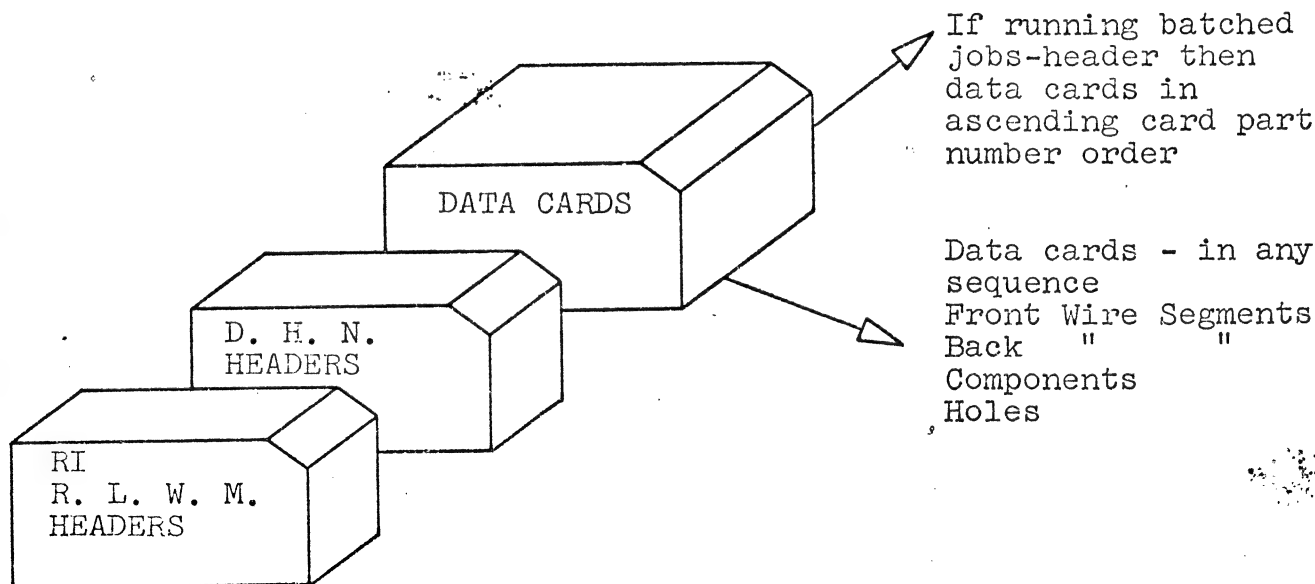
MERGN - searches the CLT and extracts the latest level note and component data. Note codes used per card is also calculated.

GANUP - generates certain notes, merges the new component data with history. (and prints input and generated header date on line)

OUTPIT - builds up the output tape in a format understandable by the 7090 CCDA programs; and prints out errata, input and program generated headers, and a summary of the run.

1401 SET/UP - PROCESSING

Deck

Before a circuit card can be processed through the computer the circuit card input must be put together as follows:

Three methods of transcription (San Jose X-Y transcriber, ACC, Alternate) are available for generating data cards. The method(s) used dictate which program should be run prior to the FORMIT system.

Method of Transcription	Program
X-Y Transcriber	TX
ACC ACC + Alternate	ACC
Alternate	FORMIT

a. Atlas Call Card - This card is omitted if the program deck is used. As outlined above the method(s) of transcription used determine which program is called out. When TX or ACC are run first, no FORMIT call card is required. At the end of these programs the on-line message "PUSH START TO LOAD NEXT PROGRAM" will appear. FORMIT is called automatically when start is pushed.

b. Circuit Card Deck(s) - as outlined above.

c. EOF Card

Column	Data
1	7/8 punch

EOF CARD 7-8 PUNCH IN COL 1

HEADERS, COMPONENTS, SEGMENT CARDS FOR OTHER CIRCUIT CARD IN RUN

HEADERS, COMPONENTS, SEGMENT CARDS FOR THIRD CIRCUIT CARD IN RUN

HEADERS, COMPONENTS, SEGMENT CARDS FOR SECOND CIRCUIT CARD IN RUN

SEGMENT CARDS FOR FIRST CIRCUIT CARD IN RUN

COMPONENT CARDS FOR FIRST CIRCUIT CARD IN RUN

HEADER CARDS FOR FIRST CIRCUIT CARD IN RUN

,008015,022029,036043,061064L080186,050057L062188,178182B170C∆ L(U6001RB001TX

IBM 5081

Tape Assignments

Drive	Tape
1	SCRATCH (optional)
2	CLT
3	OUTPUT OF TX, INPUT TO FORMIT, also used as a scratch tape during run.
4	CHT ON CHANGE RUNS
5	Output of FORMIT, input to RDTRAN (7090) also used as a scratch tape during run
6	ATLAS (optional)

Sense Switch Options

a. TX

A ON - Output will be punch cards

A&D ON - Output will be on tape drive 3

b. ACC

A ON

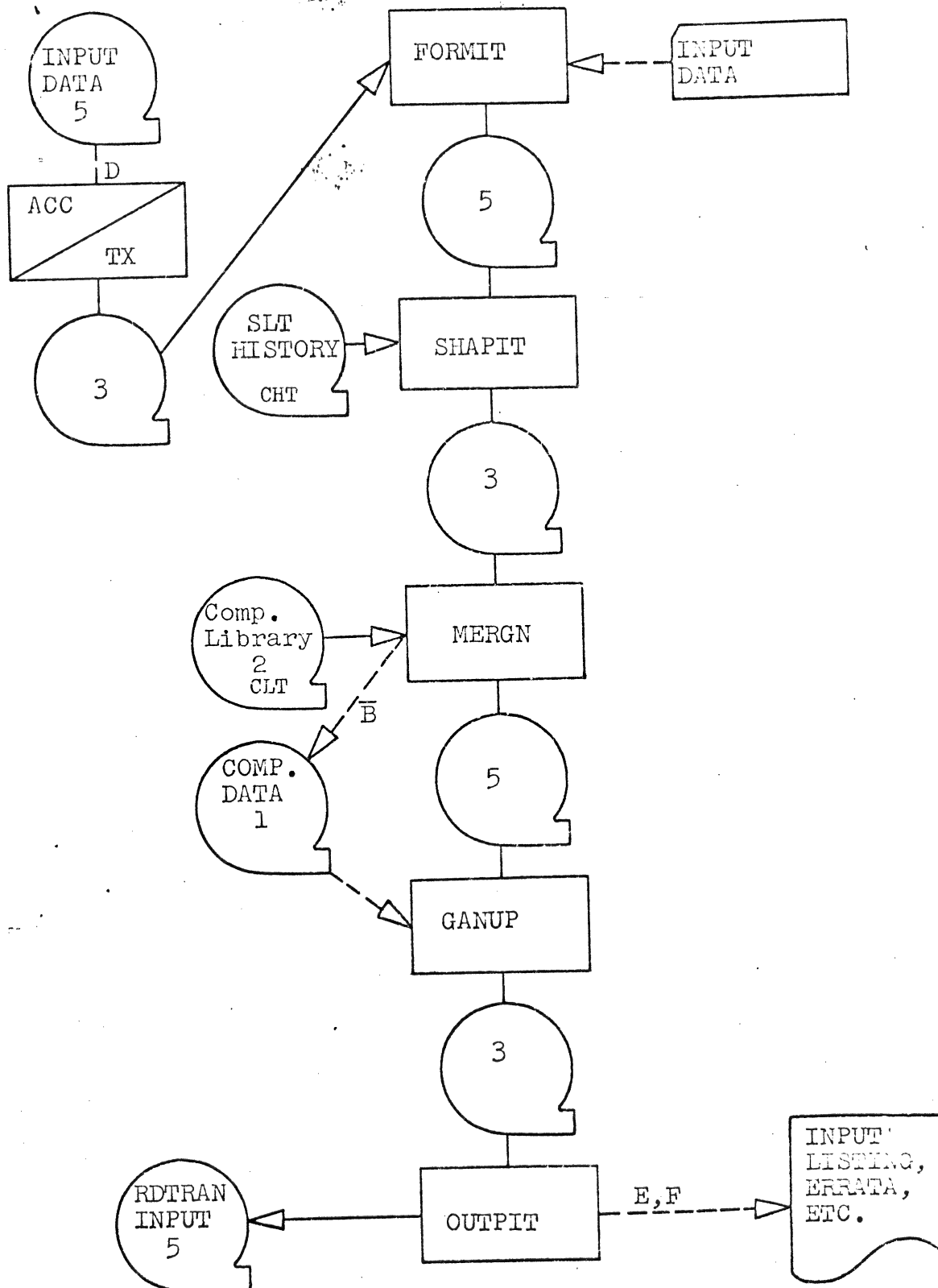
c. FORMIT SYSTEM

A ON - Errors, headers, and component definer segments for all cards with errors in the run. For those cards not in error the on-line message "NO ERRORS IN P/N 580xxxx"

A&E ON - Errors, headers, and component definer segments for all cards in the run

A&F ON - Complete data for error cards only

A,E,&F ON - Complete data for all cards in run

B ON - Scratch tape option on drive 1 is not used. When a tape drive is available a scratch tape should be mounted on drive 1. When this is done the CLT is searched once for all components on the cards in the batch and the information is written on this tape; otherwise the CLT must be searched once for every card in the batch.

1401 OUTPUT

Documents -

A summary of the run with appropriate errata is printed with every run. The extent of this printout is controlled by the switch options described in the set-up section.

The following header conversions are given as an aid to understanding the 1401 printout.

R, L, W, and M headers are converted to E, F, S, A, J, and H headers. The latter set of headers are used in the system. Some D, H, and N headers are input and/or generated by the programs. These headers are also used in the system. The following list shows the conversion that takes place.

Cols.	Data	Derivation	
E Header			
1	E		
2-10	Raw Card Part Number	R1	3-11
11-12	Front and Back Artwork Level Code	R3	29-30
13-14	Front and Back Artwork Level Code	R3	29-30
15-22	Raw Card E. C. Number	R1	12-19
23	Original or Change Run	R1	20
24-31	Previous Assembly EC Number	W2	4-11
32-40	Front Artwork Part Number	R1	3-11
41-48	Front Artwork E. C. Number	R1	12-19
49-60	Machine Type	M2	3-14
F Header			
1	F	R1	3-11
2-10	Back Artwork Part Number	R1	3-11
11-18	Back Artwork E. C. Number	R1	12-19
19-27	Front Artwork Part Number	R1	3-11
28-35	Front Artwork E. C. Number	R1	12-19
36-44	Back Artwork Part Number	R1	3-11
45-52	Back Artwork E. C. Number	R1	12-19
53-58	Card Size - Actual Max. XY Generated And Used By Programs	R2	3-8
S Header			
1	S		
2-61	Assembly Drawing Title	W1	3-62
A Header			
1	A		
2-10	Hole Pattern Part Number	R1	3-11
11-18	Hole Pattern EC Number	R1	12-19
19-30	Originating Location	M1	3-14
43-48	Quantity Machine	M2	15-20
49-54	Quantity 6 Months	M2	21-26
55-60	Quantity First Year	M2	27-32

Cols.	Data	Derivation	
J Header			
1	J		
2-29	Account Number	M1	15-42
32-37	*Packaging Specification Number	W3	3-8
50-53	Circuit Family and Speed	W2	12-15
HAUTBOMAPPROV Header			
1-13	HAUTBOMAPPROV		
16-18	Circuit Approval Initials	W3	14-16
19-24	Circuit Approval Date	W3	17-22
25-27	Designer's Initials	M3	25-27
28-33	Designer's Date	M3	28-33
34-36	Detailer's Initials	M3	34-36
37-42	Detailer's Date	M3	37-42
43-45	Checker's Initials	M3	43-45
46-51	Checker's Date	M3	46-51
52-54	Approval Initials	M3	52-54
55-60	Approval Date	M3	55-60
HAUTBOMCODESM Header			
1-13	HAUTBOMCODESM		
16-21	*Standards Code	W2	18-23
HENGDESSTATUS Header			
1-13	HENGDESSTATUS		
16-17	Assembly Status and Approval Code	W3	12-13
18-19	Raw Card Status and Approval Code	R2	17-18

* Generated by program unless overridden

Cols.	Data	Derivation
HENGDESMTCODE Header		
1-13	HENGDESMTCODE	
16-23	Material Drawing Number	R2 9-16
HHOLPATCONTROL Header		
1-13	HHOLPATCONTROL	
14-22	Hole Pattern Part Number	R1 3-11
23-30	Hole Pattern Engineering Change Number	R1 12-19
3 39	Hole Pattern Part Number	R1 3-11
40-47	Previous H/P Engineering Change Number	L1 21-28
54	(O) for original, (C) for change or (H) history	L1 20
5 57	Automatic Hole SW (Yes or No)	L1 29-31

On change runs only the R, L, W, and M headers input are listed here. All other headers input are listed below under REWORK.

Input headers listed first. The program considers "Q" cards as headers. "Q" cards needed only in Phase 1 with LR31 run.

UNCHANGED HISTORY DATA
Headers created from input are listed under REWORK. History and rework headers are combined in the 7090.

```
            PART NUMBER  5801889      E.C.  167222 A                        PAGE  1
R15832194   167222 AC
"21-12  IP811813AR
W2 167222 A
K29952            3      450    1000

HISTORY.............PART NUMBER  5801889      E.C.  167222 A.........................................HISTORY

D011066                                                                    890911
HENGDESADSPEC   A 873563A 873484A 872336A 811800
HAUTBOMDATA     020F04
HAUTBOMVOLT  12D03&12D08GND
QA00101078108 B2390721          02073108
QA00201078098 B2390721          02073098
QA00301078078 M361479           02073078
QA00406078073 B2390787          05073073
QA00501078053 M361446           02073053
QA00601078048 B2390733          02073048
QA00701078028 M361446           02073028
QA00801058078 M361479           02053078
QA00901058053 M361446           02053053
QA01001058028 M361446           02053028
QA01106048098 B2390721          05043098
QA01201048073 B2390787          02043073
QA01301048048 B2390787          02043048
QA01401038078 M361479           02033078
QA01501038053 M361446           02033053
QA01601038028 M361446           02033028
QB001V06EJAA1 01A/004-104D-02/005-112E-09
QB002V06EJAA1 02B/005-109E-07
QB003V06EJAB1 01A/004-104D-04/007-112E-09
QB004V06EJAB1 02B/007-109E-07
QB005V06EJAC1 01A/013-104D-02/010-112E-09
QB006V06EJAC1 02B/010-109E-07
QB007V06EJAD1 01A/012-104D-04/016-112E-09
QB008V06EJAD1 02B/016-109E-07
QB009V06EJAE1 01A/013-104D-04/009-112E-09
QB010V06EJAE1 02B/009-109E-07
QB011V06EJAF1 01A/012-104D-02/015-112E-09
QB012V06EJAF1 02B/015-109E-07
QB013S06EAAG1    /006-109D-06
QB014V05EBAH1    /002-109F-03/003-107F-09
QB015V05EBAJ1    /002-109F-06/003-107F-03
QB016V05EBAK1    /001-109F-03/008-107F-09
QB017V05EBAL1    /011-109F-06/014-107F-03
QB018V05EBAM1    /001-109F-06/008-107F-03
QB019V05EBAN1    /011-109F-03/014-107F-09
E5832194        167222 AD            5832194  167222 A9952
F5832194   167222 A5832194   167222 A5832194   167222 A083127
S6 NPL MPX LINE RECEIVERS
A5832194   167222 AENDICOTT                  3      450     1000
J0091-7387-9952-31682-XXX-201  890913              SRETL
HAUTBOMAPPROV  SJZ113165JRB121665RJM122265GWK010366
HAUTBOMCODESM  2-7045
HENGDESSTATUS  ARAR
HENGDESMTCODE  IP811370
```

PART NUMBER 5801889 E.C. 167222 A

MHOLPATCONTRL

0		20 25B	1		20 85000
0		20 85B	1		28 85000
0		21 26B	2		28 26000
0		23 18B	3	0	23 23000
0	0	23 58B	5		23 60000
0	0	23 78A	6		24 78000
0		24 81B	2		26 83000
0		25 20B	1		28 20000
0		25 60B	4		26 61000
0		25 76B	5		38 76000
0		26 35B	7	0	28 33000
0		26 61B	4		26 73000
0		26 80A	6		30 80000
0		28 18B	1		28 20000
0	0	28 28B	8		30 30000
0		28 36B	0		30 34000
0	0	28 53B	9		30 55000
0		28 85B	1	0	28 88000
0		30 20B	11		30 27000
0		30 27B	11		31 28000
0		30 36B	11		30 40000
0		30 40B	11		31 41000
0		30 53B	8		31 54000
0		30 75B	9		35 75000
0		30 88A	6	0	33 88000
0		31 21B	12		38 21000
0		31 28B	11		31 35000
0		31 37B	13		33 35000
0		31 41B	11		31 51000
0		31 54B	8		31 73000
0		33 18B	11		33 20000
0		33 26B	12		36 26000
0	0	33 38A	15	0	38 43000
0	0	33 58B	12		35 58000
0		33 85B	14		40 85000
0		35 25B	14		41 25000
0		35 51B	12		40 51000
0		35 71B	9		43 71000
0		36 36B	12		40 36000
0	0	38 73B	5		38 76000
0		40 75B	14		40 85000
0		40 85B	14		40100000
0		41 25B	14		41 70000
0		41 80B	16		41 98000
0		41 98B	16	0	43 98000
0		43 46B	18	0	43 48000
0		43 71B	9	0	43 73000
0		45 28B	18		45 44000
0		45 46B	16		45 61000
0		45 61B	16		46 61000
0		45100B	14		45108000
0		46 31B	16		46 45000
0		46 47B	20		46 58000
0		46 50B	20	0	48 58000
0		48 18A	21	0	48 23000
0		48 45B	20		50 45000
0		48 49A	22		50 51000

0		20 25B	1		25 25000
0		21 26B	2		21 81000
0		21 81B	2		24 81000
0	0	23 33B	4		25 33000
0		23 60B	5		25 62000
0		24 78A	6		26 80000
0		25 20B	1		25 25000
0		25 33B	4		25 60000
0		25 62B	5		25 76000
0		26 35B	7		26 59000
0		26 59B	7		28 61000
0		26 73B	4	0	28 73000
0		26 83B	2	0	28 83000
0	0	28 23B	2		28 26000
0		28 36B	8		28 40000
0		28 40B	8		30 42000
0		28 61B	7	0	28 63000
0	0	28 98B	10	0	33 93000
0		30 20B	11		33 20000
0		30 30B	8		30 34000
0		30 36B	11		31 35000
0		30 42B	8		30 53000
0		30 55B	9		30 75000
0		30 80A	6		30 88000
0		31 21B	12		31 24000
0		31 24B	12		33 26000
0		31 37B	13		31 39000
0		31 39B	13		33 41000
0		31 51B	11	0	33 53000
0		31 73B	8	0	33 73000
0	0	33 23B	14		35 25000
0	0	33 33B	13		33 35000
0		33 41B	13	0	33 43000
0	0	33 83B	14		33 85000
0	0	33 88A	6	0	38 93000
0		35 51B	12		35 58000
0		35 71B	9		35 75000
0		36 26B	12		36 36000
0		38 18B	12		38 21000
0		40 36B	12		40 51000
0		40 75B	14		45 75000
0		40100B	14		45100000
0		41 70B	14		45 70000
0		41 80B	16		46 80000
0		43 18B	17	0	43 23000
0		43 46B	18		45 44000
0	0	43 88B	19	0	48 83000
0		45 28B	18	0	48 28000
0		45 46B	16		46 45000
0		45 70B	14		45 75000
0		45108B	14	0	48108000
0		46 31B	16		50 [illegible]1000
0		46 47B	20		48 45000
0		46 61B	16		46 80000
0	0	48 33B	20		50 35000
0	0	48 48A	22		48 49000
0	0	48 63A	22		50 63000

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0	0	48 73A	22		50 73000
0		50 23B	16		50 31000
0		50 35B	20		50 45000
0		50 63A	22		50 73000
0		50 73A	22	0	53 73000
0		50 98A	22	0	53 98000
0		51 25B	23		51 33000
0		51 33B	23	0	53 33000
0		51 46B	24		53 46000
0		52 50B	24		56 50000
0		53 21B	23		55 21000
0		53 41B	24	0	53 43000
0	0	53 43B	24		53 46000
0	0	53 58B	27		56 58000
0	0	53 83B	28		55 83000
0	0	53108A	22		53110000
0		55 21B	23		55 25000
0		55 30B	24		59 30000
0		55 41A	26		56 40000
0		56 20B	25		56 28000
0		56 40A	26		60 40000
0		56 55B	24		60 55000
0		56 93B	27		56105000
0		58 13B	25		58 20000
0	0	58 78B	24		60 78000
0		59 30B	24		60 29000
0		60 20B	24		63 20000
0		60 31A	26		61 30000
0		60 38A	26	0	63 38000
0		61 30A	26		64 30000
0	0	63 33B	31		65 33000
0		63 71B	31		65 69000
0		63 86B	33	0	63 88000
0		64 30A	26		65 29000
0		65 25A	26		70 25000
0		65 71A	32		65 78000
0		66 32B	34		66 65000
0		66 65B	34		68 65000
0	0	68 28B	34		68 30000
0	0	68 38B	37		70 38000
0		68 56B	37		70 54000
0		68 65B	34		70 67000
0		68 75B	37	0	68 78000
0	0	68 78B	37	0	68 83000
0		70 20A	26		70 25000
0		70 38B	37		70 54000
0		70 56B	33		71 55000
0		70 62B	37		70 65000
0		70 67B	34		70 73000
0		70 76B	33		75 76000
0		71 41B	36		75 41000
0		71 43B	33	0	73 43000
0		71 57B	36		73 55000
0		71 61B	33		71 64000
0		71 66B	37		71 75000
0		71 80B	36		74 80000
0		73 18A	26		73 20000
0	0	73 58B	38		76 58000

0	0	48 98A	22		50 98000
0		50 23B	16	0	53 23000
0		50 51A	22		50 63000
0		50 73A	22		50 98000
0		50 98A	22		50108000
0		50108A	22	0	53108000
0		51 25B	23		55 25000
0		51 46B	24		51 49000
0		51 49B	24		52 50000
0		53 18B	23		53 21000
0	0	53 28B	25		56 28000
0		53 41B	24		55 39000
0	0	53 48A	26		55 48000
0	0	53 68B	28		55 68000
0	0	53 93B	27		56 93000
0		53110A	22		68110000
0		55 30B	24		55 39000
0		55 41A	26		55 48000
0		55 68B	28		55 83000
0		56 20B	25		58 20000
0		56 50B	24		56 55000
0		56 58B	27		56 93000
0		56105B	27		73105000
0	0	58 43A	29	0	63 48000
0	0	58 93A	30	0	63 98000
0		60 20B	24		60 29000
0		60 31A	26		60 38000
0		60 38A	26		60 40000
0		60 55B	24		60 78000
0		63 18B	24		63 20000
0		63 71B	31	0	63 73000
0	0	63 78A	32		65 78000
0		63 86B	33		70 86000
0		65 25A	26		65 29000
0		65 33B	31		65 69000
0		65 71A	32	0	68 68000
0		66 32B	34		68 30000
0		68 18B	35	0	68 23000
0	0	68 33B	36		71 33000
0		68 56B	37		68 60000
0		68 60B	37		70 62000
0	0	68 73B	34		70 73000
0		68 75B	37		71 75000
0	0	68108A	22		68110000
0		70 20A	26		73 20000
0		70 56B	33		70 60000
0		70 60B	33		71 61000
0		70 65B	37		71 66000
0		70 76B	33		70 86000
0		71 33B	36		71 41000
0		71 43B	33		71 55000
0		71 57B	36		71 59000
0		71 59B	36		73 61000
0		71 64B	33		73 66000
0		71 80B	36		71 93000
0		71 93B	36	0	73 93000
0		73 55B	36		75 55000
0		73 61B	36		76 61000

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O		73 66B	33		75 66000
C	O	73 88A	40	O	78 93000
O		73105B	27	O	73108000
O		75 41B	36		75 55000
O		76 20B	38		76 58000
O		76 61B	36		76 78000
O	O	78 93A	40	O	78 98000
O	O	78108A	40		80108000
B		20 23B	41		20 91000
B		20 91B	41		33 91000
B		21 25B	42	O	23 23000
B		21 43B	43		21 88000
B		21 88B	43	O	23 88000
B		23 35A	44	O	23 38000
B		23 41B	43	O	23 43000
B		23 60A	45	O	23 63000
B	O	23 68B	46		23 70000
B		23 70B	46		33 70000
B		23 95A	47		38 95000
B		26 78B	48	O	28 78000
B		28 18B	49	O	28 23000
B		28 30B	50		41 30000
B		28 45A	51		34 45000
B		28 50B	52		38 50000
B	O	28 83B	54		30 85000
B		28 86B	55		43 86000
B		33 20B	56	O	33 23000
B		33 25B	57	O	33 28000
B		33 31B	58	O	33 33000
B		33 41B	43	O	33 43000
B		33 56B	60	O	33 58000
B	O	33 63A	53	O	38 68000
B		33 70B	46		35 70000
B		33 80B	61		48 80000
B	O	33 98A	62		33100000
B		34 45A	51		36 43000
B		35 70B	46		35 78000
B		36 43A	51	O	38 43000
B		38 45B	59		40 45000
B		38 50B	52		40 52000
B		38 95A	47	O	38 98000
B		40 20B	57		40 25000
B		40 45B	59		40 48000
B		40 52B	52		40 53000
B		40 56B	60		40 58000
B		41 26B	50		41 30000
B		41 40B	42		41 46000
B		41 51B	63		45 51000
B		41 98B	48	O	43 98000
B		42 60B	60		49 60000
B		43 18B	57		43 20000
B	O	43 33B	64	O	48 33000
B		43 35A	44		63 35000
B		43 45B	65		53 45000
B	O	43 63A	45	O	48 63000
B		43 65B	66		50 65000
B		43 86B	55	O	43 88000
B		45 58B	63	O	48 58000

O	O	73 83B	39	O	78 78000
O	O	73 93B	36	O	73 98000
O		74 80B	36		76 78000
O		75 66B	33		75 76000
O		76 20B	38		78 20000
O		78 18B	38		78 20000
O	O	78 98A	40		80 98000
O		80 98A	40		80108000
B		20 23B	41		23 20000
B		21 25B	42		21 40000
B		21 40B	42		41 40000
B		21 43B	43	O	23 43000
B		23 18B	41		23 20000
B		23 35A	44		43 35000
B		23 41B	43		33 41000
B		23 60A	45		39 60000
B	O	23 68B	46	O	28 63000
B		23 95A	47	O	23 98000
B		26 78B	48		26 90000
B		26 90B	48		41 90000
B		28 30B	50	O	28 [illegible]
B	O	28 43A	51		28 [illegible]
B	O	28 48B	52		28 50000
B	O	28 63A	53	O	33 63000
B		28 86B	55	O	28 [illegible]
B		30 85B	54		60 85000
B		33 20B	56		38 20000
B		33 25B	57		40 25000
B		33 31B	58		53 31000
B	O	33 48B	55		35 48000
B		33 56B	60		40 56000
B	O	33 68B	46		33 70000
B		33 80B	61	O	33 83000
B		33 91B	41	O	33 93000
B		33100A	62		48100000
B		35 48B	59		38 45000
B		35 78B	46	O	38 78000
B		38 18B	56		38 20000
B	O	38 48B	63		41 51000
B	O	38 93A	47		38 95000
B		39 60A	45		42 63000
B		40 20B	57		43 20000
B		40 48B	59		42 50000
B		40 53B	52		43 56000
B		40 58B	60		42 60000
B		41 26B	50		43 26000
B		41 46B	42		63 46000
B		41 90B	48		41 98000
B		42 50B	59		48 50000
B		42 63A	45	O	43 63000
B	O	43 23B	50		43 26000
B		43 35A	44	O	43 38000
B	O	43 43B	65		43 45000
B		43 56B	52	O	43 58000
B		43 65B	66	O	43 68000
B	O	43 78A	67		45 78000
B		45 51B	63		45 58000
B		45 70A	67		45 78000

O and B segments only printed when sense switch F is on.

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PAGE 5

B		45 70A	67		48 70000
B		48 20B	68		50 20000
B	0	48 48A	70	0	53 48000
B	0	48 63A	45		51 60000
B		48 70A	67		58 70000
B	0	48 83B	71	0	53 83000
B	0	48108B	72		48110000
B		49 60B	60		50 59000
B		50 23B	68	0	53 23000
B		50 53B	60	0	53 53000
B		51 60A	45		60 60000
B		53 20B	73		55 20000
B	0	53 38A	69	0	58 43000
B		53 55B	74	0	53 53000
B	0	53 63A	67	0	58 68000
B	0	53 98A	76		53100000
B		55 20B	73		55 25000
B	0	58 68A	67		58 70000
B	0	58 75B	77		70 75000
B		58108B	72		58110000
B		60 31B	73		68 31000
B		60 50B	74		75 50000
B		60 81B	54		60 85000
B		61 86B	78		61 98000
B		63 18B	79		63 20000
B		63 35A	44	0	63 38000
B		63 45B	42		63 46000
B	0	63 50B	80		66 61000
B		63 70B	81		71 70000
B		63110A	82		78110000
B		65 30B	79		70 30000
B		68 18B	74		68 20000
B	0	68 23B	83		68 26000
B		68 31B	73	0	68 33000
B	0	68 43A	84	0	73 38000
B	0	68 68A	85	0	73 63000
B	0	68 98A	76		68100000
B		70 25B	74		76 25000
B		70 75B	77		70 80000
B		71 53B	77		71 60000
B		71 70B	81		71 76000
B		71 76B	81		78 76000
B	0	73 38A	84		73 39000
B	0	73 43B	42		73 45000
B	0	73 63A	85		73 64000
B	0	73 68B	81		73 70000
B		73 81B	54	0	73 83000
B		75 46B	74		80 46000
B		76 39B	74		78 41000
B		76 64B	80		77 65000
B		77 43A	84	0	78 43000
B		77 68A	85	0	78 68000
B	0	78 23B	87		81 23000
B	0	78 48B	87		81 48000
B	0	78108A	82		78110000
B		80 65B	80		80 70000
B		81 60B	77		81 80000

B		48 18B	68		48 20000
B	0	48 43A	69	0	53 38000
B		48 50B	59	0	48 53000
B	0	48 68A	67		48 70000
B	0	48 78B	61		48 80000
B	0	48 98A	62		48100000
B		48110B	72		58110000
B		50 20B	68		50 23000
B		50 53B	60		50 59000
B		50 65B	66	0	53 68000
B		53 18B	73		53 20000
B		53 31B	58	0	53 33000
B	0	53 43B	55		53 45000
B		53 55B	74		60 55000
B	0	53 88A	75	0	58 93000
B		53100A	76		68100000
B		55 25B	73		60 25000
B	0	58 73B	77		58 75000
B	0	58 98B	78		61 98000
B		60 25B	73		60 31000
B		60 50B	74		60 55000
B		60 60A	45	0	63 63000
B		60 81B	54		73 81000
B		61 86B	78		68 86000
B		63 20B	79		65 20000
B	0	63 43B	42		63 45000
B		63 45B	42		73 45000
B	0	63 68B	81		63 70000
B	0	63108A	82		63110000
B		65 20B	79		65 30000
B		66 61B	80		76 61000
B		68 20B	74		70 20000
B		68 26B	83		73 26000
B	0	68 38B	79		70 38000
B	0	68 53B	77		71 53000
B	0	68 83B	78		68 86000
B		70 20B	74		70 25000
B		70 30B	79		70 38000
B		70 80B	77		81 80000
B		71 60B	77		81 60000
B		71 70B	81		73 70000
B		73 26B	83	0	73 28000
B		73 39A	84		77 43000
B	0	73 53B	86	0	73 58000
B		73 64A	85		77 68000
B	0	73 73B	80		76 70000
B		75 46B	74		75 50000
B		76 25B	74		76 39000
B		76 61B	80		76 64000
B		76 70B	80		80 70000
B		77 65B	80		80 65000
B		78 18B	87	0	78 23000
B		78 41B	74		80 41000
B		78 76B	81	0	78 78000
B		80 41B	74		80 46000
B		81 23B	87		81 48000

REWORK..............PART NUMBER 5801889 E.C. 167222 A...REWORK

Diagnostics shifted to the left.

Non-definer G-segments only printed when sense switch F is on.

Components and notes are reworked from CLT each time a card is processed.

```
            PART NUMBER  5801889      E.C.  167222 A                              PAGE  6

D012766                                                    890911
L1 HDR MISSING.  ASSUMING ORIGINAL. CARD NO. 5801889
E5832194       167222$AC167222$A5832194  167222$A9952
F5832194   167222$A5832194   167222$A5832194   167222$A083127
A5832194   167222$A                          3      450    1000
J                                 890913
HAUTBOMCODESM  2-7045
HENGDESSTATUS    AR
HENGDESMTCODE  IP811813
HHOLPATCONTRL5832194  167222$A5832194            0831270
GA05G 05 58108      04  G 04 63108000       GA04G 04 63108      03  G 03 68108000
GA03G 03 68108      02  G 02 73108000       GA02G 02 73108      01  G 01 78108000
GA05G 05 58 98      04  G 04 63 98000       GA04G 04 63 98      03  G 03 68 98000
GA03G 03 68 98      02  G 02 73 98000       GA02G 02 73 98      01  G 01 78 98000
GA03G 03 68 78      02  G 02 73 78000       GA04G 04 63 78      03  G 03 68 78000
GA04G 04 63 78      05  G 05 63 83000       GA05G 05 63 83      06  G 06 63 88000
GA06G 06 63 88      07  G 07 63 93000       GA07G 07 63 93      08  G 08 68 93000
GA08G 08 68 93      09  G 09 73 93000       GA09G 09 73 93      10  G 10 78 93000
GA11G 11 78 88      10  G 10 78 93000       GA12G 12 78 83      11  G 11 78 88000
GA02G 02 58 73      03  G 03 63 73000       GA03G 03 63 73      04  G 04 68 73000
GA04G 04 68 73      05  G 05 73 73000       GA05G 05 73 73      06  G 06 78 73000
GA03G 03 68 53      02  G 02 73 53000       GA04G 04 63 53      03  G 03 68 53000
GA04G 04 63 53      05  G 05 63 58000       GA05G 05 63 58      06  G 06 63 63000
GA06G 06 63 63      07  G 07 63 68000       GA07G 07 63 68      08  G 08 68 68000
GA08G 08 68 68      09  G 09 73 68000       GA09G 09 73 68      10  G 10 78 68000
GA11G 11 78 63      10  G 10 78 68000       GA12G 12 78 58      11  G 11 78 63000
GA05G 05 58 48      04  G 04 63 48000       GA04G 04 63 48      03  G 03 68 48000
GA03G 03 68 48      02  G 02 73 48000       GA02G 02 73 48      01  G 01 78 48000
GA03G 03 68 28      02  G 02 73 28000       GA04G 04 63 28      03  G 03 68 28000
GA04G 04 63 28      05  G 05 63 33000       GA05G 05 63 33      06  G 06 63 38000
GA06G 06 63 38      07  G 07 63 43000       GA07G 07 63 43      08  G 08 68 43000
GA08G 08 68 43      09  G 09 73 43000       GA09G 09 73 43      10  G 10 78 43000
GA11G 11 78 38      10  G 10 78 43000       GA12G 12 78 33      11  G 11 78 38000
GA03G 03 48 78      02  G 02 53 78000       GA04G 04 43 78      03  G 03 48 78000
GA04G 04 43 78      05  G 05 43 83000       GA05G 05 43 83      06  G 06 43 88000
GA06G 06 43 88      07  G 07 43 93000       GA07G 07 43 93      08  G 08 48 93000
GA08G 08 48 93      09  G 09 53 93000       GA09G 09 53 93      10  G 10 58 93000
GA11G 11 58 88      10  G 10 58 93000       GA12G 12 58 83      11  G 11 58 88000
GA03G 03 48 53      02  G 02 53 53000       GA04G 04 43 53      03  G 03 48 53000
GA04G 04 43 53      05  G 05 43 58000       GA05G 05 43 58      06  G 06 43 63000
GA06G 06 43 63      07  G 07 43 68000       GA07G 07 43 68      08  G 08 48 68000
GA08G 08 48 68      09  G 09 53 68000       GA09G 09 53 68      10  G 10 58 68000
GA11G 11 58 63      10  G 10 58 68000       GA12G 12 58 58      11  G 11 58 63000
GA03G 03 48 28      02  G 02 53 28000       GA04G 04 43 28      03  G 03 48 28000
GA04G 04 43 28      05  G 05 43 33000       GA05G 05 43 33      06  G 06 43 38000
GA06G 06 43 38      07  G 07 43 43000       GA07G 07 43 43      08  G 08 48 43000
GA08G 08 48 43      09  G 09 53 43000       GA09G 09 53 43      10  G 10 58 43000
GA11G 11 58 38      10  G 10 58 43000       GA12G 12 58 33      11  G 11 58 38000
GA02G 02 28 98      03  G 03 33 98000       GA03G 03 33 98      04  G 04 38 98000
GA04G 04 38 98      05  G 05 43 98000       GA05G 05 43 98      06  G 06 48 98000
GA05G 05 28 73      04  G 04 33 73000       GA04G 04 33 73      03  G 03 38 73000
GA03G 03 38 73      02  G 02 43 73000       GA02G 02 43 73      01  G 01 48 73000
GA05G 05 28 48      04  G 04 33 48000       GA04G 04 33 48      03  G 03 38 48000
GA03G 03 38 48      02  G 02 43 48000       GA02G 02 43 48      01  G 01 48 48000
GA03G 03 28 78      02  G 02 33 78000       GA04G 04 23 78      03  G 03 28 78000
GA04G 04 23 78      05  G 05 23 83000       GA05G 05 23 83      06  G 06 23 88000
GA06G 06 23 88      07  G 07 23 93000       GA07G 07 23 93      08  G 08 28 93000
GA08G 08 28 93      09  G 09 33 93000       GA09G 09 33 93      10  G 10 38 93000
```

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PART NUMBER  58Q1889      E.C.  167222 A                                   PAGE  7

GA11G 11 38 81          10  G 10 38 93000          GA12G 12 38 83          11  G 11 38 88000
GA03G 03 28 53          02  G 02 33 53000          GA04G 04 23 53          03  G 03 28 53000
GA04G 04 23 53          05  G 05 23 58000          GA05G 05 23 58          06  G 06 23 63000
GA06G 06 23 63          07  G 07 23 68000          GA07G 07 23 68          08  G 08 28 68000
GA08G 08 28 68          09  G 09 33 68000          GA09G 09 33 68          10  G 10 38 68000
GA11G 11 38 63          10  G 10 38 68000          GA12G 12 38 58          11  G 11 38 63000
GA03G 03 28 28          02  G 02 33 28000          GA04G 04 23 28          03  G 03 28 28000
GA04G 04 23 28          05  G 05 23 33000          GA05G 05 23 33          06  G 06 23 38000
GA06G 06 23 38          07  G 07 23 43000          GA07G 07 23 43          08  G 08 28 43000
GA08G 08 28 43          09  G 09 33 43000          GA09G 09 33 43          10  G 10 38 43000
GA11G 11 38 38          10  G 10 38 43000          GA12G 12 38 33          11  G 11 38 38000
GA   G 02 73 53 M361446     G 01 78 53153
       490 490230 25    1212
      5188481201 5063481202
      4938481203 4813481204
      4813493705 4813506206
      4813518707 4938518708
      5063518709 5188518710
      5188506211 5188493712
                 TLR-B700
GA   G 02 73 28 M361446     G 01 78 28153
       490 490230 25    1212
      5188481201 5063481202
      4938481203 4813481204
      4813493705 4813506206
      4813518707 4938518708
      5063518709 5188518710
      5188506211 5188493712
                 TLR-B700
GA   C 02 53 53 M361446     G 01 58 53153
       490 490230 25    1212
      5188481201 5063481202
      4938481203 4813481204
      4813493705 4813506206
      4813518707 4938518708
      5063518709 5188518710
      5188506211 5188493712
                 TLR-B700
GA   G 02 53 28 M361446     G 01 58 28153
       490 490230 25    1212
      5188481201 5063481202
      4938481203 4813481204
      4813493705 4813506206
      4813518707 4938518708
      5063518709 5188518710
      5188506211 5188493712
                 TLR-B700
GA   G 02 33 53 M361446     G 01 38 53153
       490 490230 25    1212
      5188481201 5063481202
      4938481203 4813481204
      4813493705 4813506206
      4813518707 4938518708
      5063518709 5188518710
      5188506211 5188493712
                 TLR-B700
GA   G 02 33 28 M361446     G 01 38 28153
       490 490230 25    1212
```

```
     5188481201 5063481202
     4938481203 4813481204
     4813493705 4813506206
     4813518707 4938518708
     5063518709 5188518710
     5188506211 5188493712
                TLR-B700
GA  G 02 73 78 M361479          G 01 78 78153
     04900490230 25    1212
     5188481201 5063481202
     4938481203 4813481204
     4813493705 4813506206
     4813518707 4938518708
     5063518709 5188518710
     5188506211 5188493712
                 II 30
GA  G 02 53 78 M361479          G 01 58 78153
     04900490230 25    1212
     5188481201 5063481202
     4938481203 4813481204
     4813493705 4813506206
     4813518707 4938518708
     5063518709 5188518710
     5188506211 5188493712
                 II 30
GA  G 02 33 78 M361479          G 01 38 78153
     04900490230 25    1212
     5188481201 5063481202
     4938 8 203 4813481204
     4813493705 4813506206
     4813518707 4938518708
     5063518709 5188518710
     5188506211 5188493712
                 II 30
GA  G 06 53108 B2390721         G 05 58108088
      750 125350 23     606
     5313500001 5188500002
     5063500003 4938500004
     4813500005 4688500006
                 RC MOD
GA  G 06 53 98 B2390721         G 05 58 98088
      750 125350 23     606
     5313500001 5188500002
     5063500003 4938500004
     4813500005 4688500006
                 RC MOD
GA  G 01 23 98 B2390721         G 02 28 98088
      750 125350 23     606
     5313500001 5188500002
     5063500003 4938500004
     4813500005 4688500006
                 RC MOD
GA  G 06 53 48 B2390733         G 05 58 48088
      750 125350 23     606
     5313500001 5188500002
     5063500003 4938500004
     4813500005 4688500006
                 RC MOD
```

```
PART NUMBER  5801889       E.C.  167222 A                          PAGE  9

GA  G 01 53 73 82390787        G 02 58 73088
       75? 125350 23     606
      5313500001 5188500002
      5063500003 4938500004
      4813500005 4688500006
                   RC MOD
GA  G 06 23 73 82390787        G 05 28 73088
       750 125350 23     606
      5313500001 5188500002
      5063500003 4938500004
      4813500005 4688500006
                   RC MOD
GA  G 06 23 48 82390787        G 05 28 48088
       750 125350 23     606
      5313500001 5188500002
      5063500003 4938500004
      4813500005 4688500006
                   RC MOD
NAG01                     CARD CONFORMS TO DECOUPLING RE
NAG02                     QUIREMENTS IN 811800.
NCC01811304    0101HOUSING#P.N.#811304
NCE01811300    0101CONTACT#P.N.#811300
NFA01           X      6TECH LAB EVALUATION INCOMPLETE
NFA02           X       . PART SUBJECT TO WITHDRAWAL.
NFA03           X       ADDITIONAL USAGE TO BE AVOIDED
```

No X in position 14 signifies quantity will be calculated in RDTRAN.

```
CARDS ON OUTPUT TAPE-

5801889

CARDS WITH ERRORS-

* 5801889


* INDICATES ERRORS NOT SERIOUS ENOUGH TO DELETE FROM OUTPUT TAPE.

PRESS START TO LOAD NEXT PROGRAM FROM READER
```

Tapes

A RDTRAN input tape is generated by the OUTPIT program for processing in the 7090 system.

ERRATA - all messages are printed by OUTPIT at the end of the 1401 run except as noted.

ACC HALTS

ACC JOB COMPLETE. PUSH START TO LOAD NEXT PROGRAM

FORMIT HALTS

TAPE WRITE ERROR PRESS START TO RETRY.

TAPE READ ERROR PRESS START TO RETRY.

FORMIT COMPLETE. PRESS START TO READ NEXT PROGRAM. Appears only when running from cards.

SHAPIT MESSAGES

DELETE CALLED FOR ON A GREEN SEGMENT THAT IS NOT ON HISTORY - refers to the following G-segment.

DELETE CALLED FOR ON A NOTE THAT IS NOT ON HISTORY -refers the following note.

THIS CARD OUT OF SEQUENCE-will refer to the following-, R, M, W or L card.

COL. 4-11 DO NOT AGREE WITH HISTORY-refers to the following W2 card. The EC from history will be used.

FORMAT ERROR COLUMN XX-refers to the following-DELETENET card.

P/N XXXXXXX OUT OF SORT ON INPUT OR NOT ON HISTORY TAPE-this part number will not be processed.

BAD FORMAT ON HISTORY TAPE-this part number can not be processed

SHAPIT HALTS

TAPE ON DRIVE 4 IS NOT A HISTORY TAPE-header label did not contain CARDUPATE or SLTHISTORY in positions 21-30. Mount the correct history tape on drive 4 and press start to continue. To ignore this condition press start-reset and start.

WRONG FORMAT ON INPUT TAPE--SHAPIT-the input tape is not the correct output from FORMIT

MERGN MESSAGES

"ILLEGAL COMPONENT TYPE CALLED FOR"
The message is followed by the G card in error. The small card will be omitted from the final output tape of the system.

"BAD COMPONENT PART NUMBER"
The error G card follows the message and the small card is omitted from the final output tape.

"XXXXXXXXX ILLEGAL P/N FOR A RELEASED CARD"
The part number specified contains an alphabetic or eight numeric characters.

"COMPONENTS WITH P/N XXXXXXXXX CHANGED TO XXXXXXXXXX"
At least one match was found for the specified part number.

"CHANGE P/N TABLE FULL CARD SKIPPED"
This message is followed by the-COMPONENT card that was not processed.

"XXXXXXXXX COMPONENT TAPE LEAD DATA MISSING"
This is an on-line message. The components tape has an error in the lead data of the part number specified.

MERGN HALTS

"10 READ ERRORS DRIVE #X PUSH START FOR 10 MORE TRIES"
The designated tape drive has been read 10 times in error. The program cannot continue until the error record has been read correctly.

"END OF MERGN PUSH START TO LOAD NEXT PROGRAM"
This is the end of job message when the program is run from card decks.

GANUP MESSAGES

"DUPLICATE NOTE CARDS FOR XXXX"
Two note cards had the same note code and sequence number. The second card is skipped and will not appear on the output tape of the system.

"NOTE TABLE OVERFLOW MUST SKIP THIS N CARD"
A maximum of sixty note cards can be tabled. The messages followed by the N card. This card will not be on the system output tape.

"NOTE CODE TABLE OVERFLOW.NOTE XX SKIPPED"
A maximum of sixty note codes can be tabled. If an N card were input for this note code the note will be on the output tape but automatic calculation of the quantity cannot be done.

"COMPONENT TAPE NOTE CODE XX DIFFERENT FROM INPUT YY"
"PROGRAM WILL USE YY"
A G card follows these messages. The card was either input or came from history and in both case the G card note code will override the component's tape note code.

"COMPONENT NOT ON COMPONENTS TAPE"
The G card for the component follows the diagnostic. This error will cause the small card to be omitted from the system output tape.

"NOTE NOT ON COMPONENTS TAPE NNSSXXXXXXXXXXXX"
The note (NN) sequence (SS) is not on the components tape. The special component part number, unit of measure and quantity are also lis...

"BAD SLOPE"
The O or B segment which follows this message is not horizontal, vertical or at forty-five degrees.

"Y COORDINATE BELOW 17"
The O or B segment which follows this message has either its from or to Y coordinate below 17.

GANUP HALTS

"10 READ ERRORS ON DRIVE #X PUSH START FOR 10 MORE TRIES"

"GANUP DONE PUSH START TO LOAD NEXT PROGRAM"
This message will occur on-line only when the program was run from card decks. If start is pushed locations 1-80 are cleared, a word mark set in 1, a card read and a transfer to location is executed.

7090 PROGRAMS

RDTRAN - reads the output tape from the 1401 programs. Its three main functions are updating, sorting, and error checking.

HOLPAT - assigns hole and land sizes for component leads. It also creates and deletes holes and lands as necessary. HOLPAT also writes a tape containing all the wire segments, components, hole data, and header info. of the card being processed, which can be added to the CHT.

LILACK AND/OR LILACX - are run to provide the checks listed below. LILACX provides a more complete and accurate check than LILACK, but LILACX does not check for restricted area violations.

LILACK detects the following illegal conditions:

a. Lines less than .010 apart.
b. Lands less than .040 apart.
c. Land-line combinations less than .010 apart.
d. Intersection of lines at other than their end points.
e. Lines or lands in the card edge restricted area.
f. Lines which are not vertical, horizontal, or at 45°.
g. Land with illegal land size codes.
h. Lines which overlap each other.

LILACK limitations are:

a. Only horizontal, vertical, and 45° lines can be checked
b. Only lines of wire tape A (.031), B (.013), C (offset .013), D (.031), E (.031), F (.031), and G (.031) can be checked.
c. The program cannot process cards which exceed these input restrictions:

(1) 1500 Front Segments
(2) 1500 Back Segments
(3) 1000 Holes

LILACX detects the following conditions:

a. Lines less than .010 apart.
b. Line-land combinations less than .010 apart.
c. Land-land combinations less than .034 apart.
d. Land-pad and pad-pad combinations less than .017 apart.
e. Intersection of lines in different nets.
f. Overlap of lines in the same net.
g. Lands and lines of illegal size.
h. Lines not vertical, horizontal or at a 45° angle.
i. D, E, F, and G arcs of illegal length.

LILACX limitations are:

a. Only horizontal, vertical, 45° lines, and D, E, F, and G arcs can be checked.
b. Only lines of wire size A (.031 offset), B (.013) and C (.013 offset) can be checked.
c. Arcs D, E, F and G are treated as 45° lines of wire size A.
d. Only lands of size J (.065), K (.065), L (.085) and M (.046) can be checked.
e. Only land-pad and pad codes of A, B, C, D, E, F, G, H, N, P, Q, R, S, T, U, and V can be checked.
f. Only 2000 lands, land-pads and pads can be processed.
g. Only parallel wires in the same net (on one side of card) are checked for overlap.
h. Wires in the same net are not checked for spacing errors.
i. No card edge restriction checks are made.

ALDCOP, SPLITS, PR6, PR7, PR8, ALDCOP2-select the correct ALD pages and prepare their print images for the E. D. T.

AUTBOM - generates the assembly drawing print image which is later added to the E.D.T.

AUTWIR - generates the front and back artwork checking drawings.

ENGDES - builds the E.D.T., which contains:
Header data
Wire list front
Land list front
Wire list back
Land list back
Hole pattern
Component location list
Assembly drawing image
ALD image

ENGDUM- is used when a print out of the EDT is required.

7090 SET/UP AND PROCESSING

Prior to processing on the 7090 a request deck must be prepared. Programs are called off the system tape via chain link numbers punched into this request deck. Each program is identified by a different chain link number.

Deck -

a. Execute Card -

Columns	Data
1	"="
7-13	"Execute"

b. Date Card -

Columns	Data
1	"="
7-10	"Date"
19-24	Month, Day, Year (Ø22565, Ø22865, etc.)

c. System Call Card -

Columns	Data
1	"="
7-12	"SCMSYS"
21-24	"75ØØ"

d. Chain Link Call Card(s)

Non-EDT Run

Columns	Data
1	"+"
13-16	"7600" RDTRAN
17	"," Comma
18-21	"7605" HOLPAT
22	","
23-26	"7625" LILACK and/or "7630" LILACX
27	","
28-31	"7650" AUTBOM
32	","
33-36	"7660" AUTWIR

EDT Run - Card 1

Columns	Data
1	"+"
13-16	"7600" RDTRAN
17	","
18-21	"7605" HOLPAT
22	","
23-26	"7625" LILACK
27	","
28-31	"7640" ALDCOP
32	","
33-36	"7641" SPLITS
37	","
38-41	"7642" PR 6
42	","
43-46	"7643" PR 7
47	","
48-51	"7644" PR 8
52	","
53-56	"7645" ALDCOP2
57	","
58-61	"7650" AUTBOM
62	","
63-66	"7660" AUTWIR

EDT Run - Card 2

Columns	Data
1	"+"
13-16	"7680" ENGDES
17	","
18-21	"7685" ENGDUM (optional)

e. EOF Card

1	7/8 punch

f. STOP Card

1	"="
7-10	"STOP"

g. EOF Card

1	7/8 punch

h. Blank Card

i. Blank Card

```
                         BLANK CARD
                         BLANK CARD
8        7-8 PUNCH IN COL. 1
=     STOP
8        7-8 PUNCH IN COL. 1
+           7600,7605,7625,7650,7660
=     SCMSYS        7500
=     DATE        093065
=     EXECUTE
```

NON-EDT RUN CALL DECK

```
                                          BLANK CARD
                                          BLANK CARD
8        7-8 PUNCH IN COL. 1
=      STOP
8        7-8 PUNCH IN COL. 1
+           7680,7685
+           7600,7605,7625,7640,7641,7642,7643,7644,7645,7650,7660
=      SCMSYS        7500
=      DATE        093065
=      EXECUTE
```

EDT RUN' CALL DECK

IBM 5081

Tape Assignments

Drive	Tape
A1	Systems Tape
A3	Errata Print Tape
A5	Scratch
A6	LMT (EDT Run Only)
A7	Scratch
A8	Hole pattern master tape ring in
B1	Scratch
B2	RDTRAN input tape becomes Holpat output tape
B3	Drawing Print Tape
B4	Scratch
B5	Scratch
B6	Scratch
B7	Holpat copy

SYSTEMS TAPE A1

REQ. DECK

B2 O/P FROM 1401 ALSO IS O/P OF HOLPAT

HOLE PATTERN MASTER A8

7094 CCDA PROGRAMS

B7 HOLPAT COPY

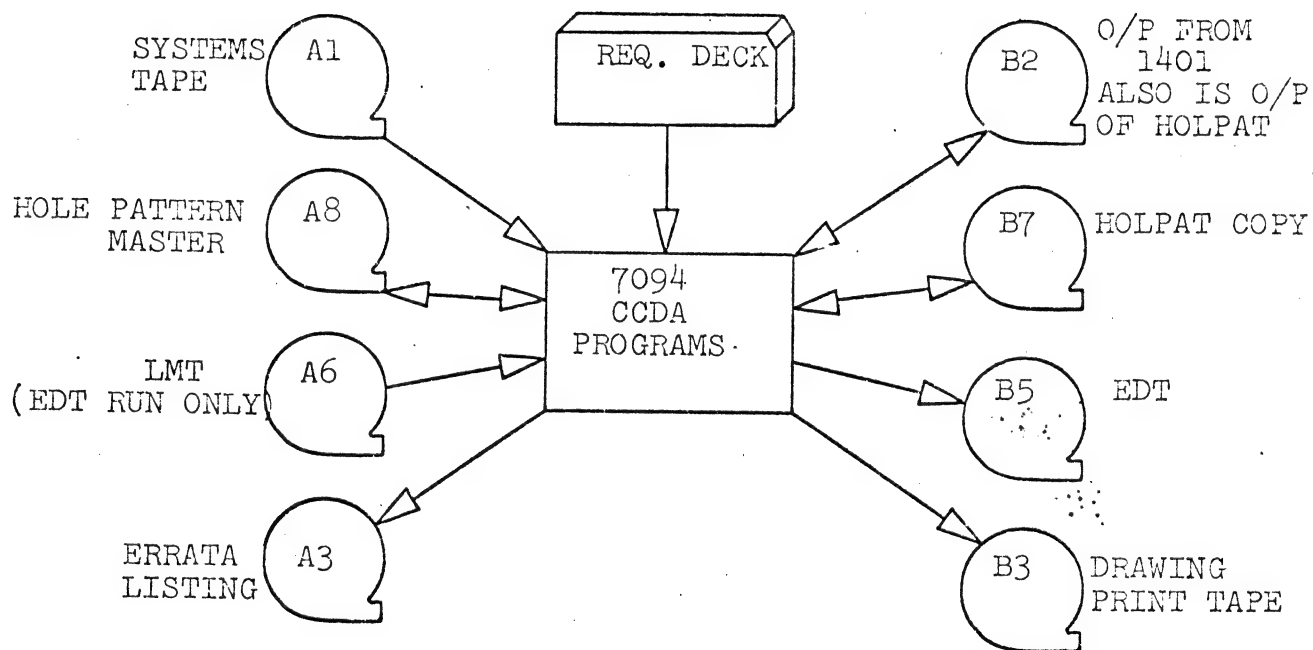
LMT (EDT RUN ONLY) A6

B5 EDT

ERRATA LISTING A3

B3 DRAWING PRINT TAPE

7090 DATA FLOW

HOLE PATTERN MASTER TAPE CREATION

This is done by going card to tape with the following four cards:

Card 1

Columns	Data
1-4	"1HDR"
16-25	"LANDUPDATE"

Card 2 & 3

1	7/8 punch

Card 4

1-4	"1EOF"

1EOF

8 7-8 PUNCH IN COL 1

8 7-8 PUNCH IN COL 1

1HDR LANDUPDATE

HOLPAT LABEL

Restarting a Run

Any time a run on the 7090 fails due to machine, tape or program trouble, that run can be restarted by rewinding all the tapes except the A3. The reason for this is that when the B2 is reread into the programs RDTRAN and HOLPAT are not run in the restarted run and any errors encountered in these programs will be on the A3 from the first try.

Methods of Creating an EDT

Several methods are available for creating an EDT besides making a full systems run through the 1401 and 7090. They are:

a. Using the B2 tape from the last 7090 run

b. Using the SHAPIT program to pull the card information from the CHT

Before either run is started, the LMT history list should be checked to make sure the ALD E. C. and the card E. C. are at the same level. If the E. C. 's are equal the run will go to completion but the ALD will not be on the EDT.

Using the B2 Tape to Obtain an EDT

If proper tape control has been maintained the B2 tape from the good CCDA run should be available for the EDT run. The request deck and tape assignments are the same as that for an EDT run. At the end of the run the A3 and B3 should be printed the same as if this were a regular run. These print outs should be checked to be sure no tape or machine problems were encountered during the run, and that the LMT data was copied correctly.

SHAPIT is a program in the 1401 system.

This method must not be used if a card being pulled from history hasn't had net numbers assigned by RDTRAN. These cards must be processed as a change run through the entire 1401-7090 CCDA.

The set-up cards required are:

Card 1 - Atlas Call Card or Program Deck
Card 2, etc. - Card Assembly P. N. in columns 1-7. There may be more than one part number requested per run. The part numbers are punched one to a card and set-up in ascending part number order.

580ZZZZ
580YYYY
580XXXX

,008015,022029,036043,061064L080186,050057L062188,178182B170C L(U6001RB001SHAPI

SHAPIT PULL.

IBM 5081

Tape Assignments

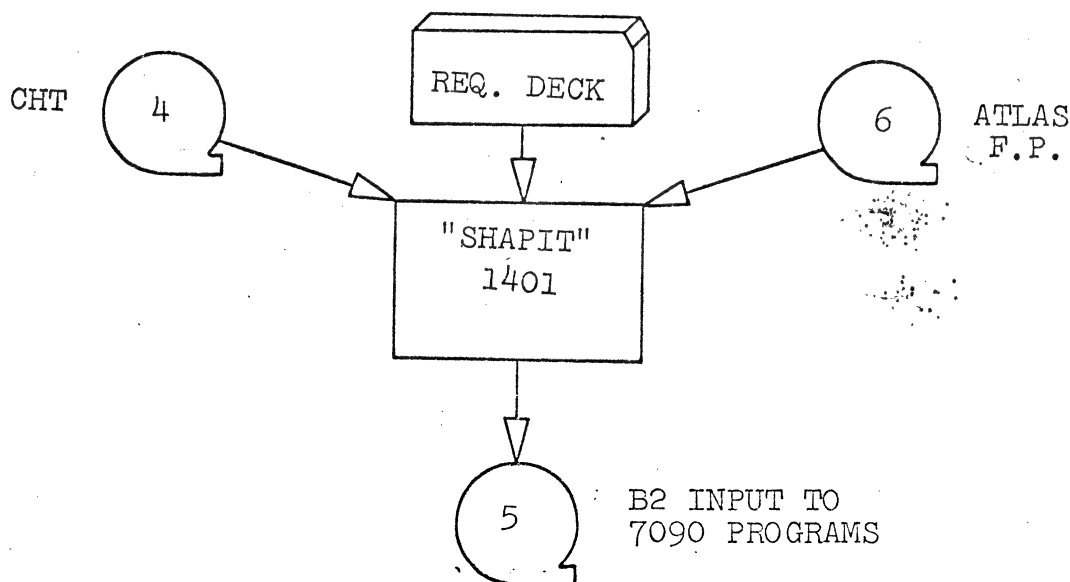
Drive	Tape
4	CHT
5	SHAPIT output-B2 input to 7090
6	Atlas (optional)

Sense Switch Options

SS	
A	ON
G	ON

Once the B2 input tape for the 7090 is created the procedure outlined under "Using the B2 tape to obtain an EDT" should be followed.

SHAPIT PULL DATA FLOW

CHT 4
REQ. DECK
6 ATLAS F.P.
"SHAPIT" 1401
5 B2 INPUT TO 7090 PROGRAMS

OUTPUT

Tapes

B2 - HOLPAT OUTPUT TAPE - is used primarily to update the CHT. For this proceedure see DEP 2-7047, Suffix 4, Section 6. The B2 can also be used as a history tape for a change run or as the B2 input for a 7090 run.

A3 - ERRATA PRINT TAPE - contains one file and is printed on a 1401-4K using a standard errata multi-utility program. ELPIP can be used.

B3 - PRINT DRAWING TAPE - contains 2 files of data which is printed using the ELPIP program, program control, sideways chain, and 15 lines per inch.

Documents

Assembly (AUTBOM) Drawing - is produced by AUTBOM. A print image of this drawing is placed on the B3 drawing print tape and the EDT. The assembly drawing from the B3 tape is used by engineering as a checking document. The print image on the EDT is printed on a special printer during the CCRP systems run. This drawing then becomes part of the engineering release package to the corporation.

Automated Wiring Diagram (AUTWIR Drawing) - is creat
the AUTWIR program and used in engineering for checki

a. Front Artwork

b. Back Artwork

c. Land-Hole Sizes

d. Notes

e. Header information (part numbers, E. C. , artwork levels, material dwg. numbers, etc.)

NOTES.

AK –			CARD HAS BEEN DECOUPLED 811800 IS NOT APPLICABLE.
CC –	811304	0101	HOUSING P.N. 4811304
CE –	811300	0116	CONTACT P.N. 4811300
FA –		25	TECH LAB EVALUATION INCOMPLETE. PART SUBJECT TO WITHDRAWAL. ADDITIONAL USAGE TO BE AVOIDED
PH –			DUE TO COMPONENT HEIGHT OF .370 TO .4000 THIS CARD MUST BE REMOVED PRIOR TO REMOVAL OF CARD ADJACENT TO COMPONENT SIDE.
HD –			HAND ASSEMBLE BEFORE LIQUID PROCESS.

U/M

QUANTITY

WIRES ARE DRAWN WITH THEIR SIZE CODE.

LAND-HOLE SIZE ARE INDICATED WITH THEIR SIZE CODE.

"X" INDICATES NON-GRID POSITIONS

ASM. PART NUMBER	5401395	E.C. NUMBER	163966 A	STATUS	AR
FRONT ARTWORK P.N.	5019667	E.C. NUMBER	163966 A	F.A. LEVEL	
RAW CARD P.N.	5019367	E.C. NUMBER	163966 A	STATUS	AR
HOLE PATTERN P.N.	5019267	E.C. NUMBER	163966 A	STATUS	
MATERIAL DRAWING P.N.	IP811071				
ACCOUNT NO.	4430-5203-13611-XXX-170				

SPEC. NO. A 874230 A 872816 A 874228 A 874229

ERRATA

RDTRAN

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	yes	"AN EOF HAS BEEN READ ON THE INPUT TAPE WHEN ONE WAS NOT EXPECTED. PROGRAM WILL GO TO END OF JOB". The reasons can be (A) wrong input tape (B) A. data record terminating in a "C" was followed by an EOF. NOTE: A LIDUMP will not reveal error(B).
yes	yes	"HEADER LABEL INCORRECT. PUSH START TO IGNORE." The program tests for FEEDTO7090" in columns 21-30 of the label.
no	yes	"THIS XXXXXX SIDE WIRE BELONGS IN NET NO XXX FROM TERMINAL FLAG IS (0,1) TO TERMINAL FLAG IS (0,1) CONSULT WRITE UP FOR FURTHER EXPLANATION". The net must be an involved multi-branch network. The program may later put this wire in that net. If it Does no incorrect LILACK errors will result. If it Does Not LILACK will flag the segments involved and the EDT must not be released to SMD. This message is very rare and should never appear under normal circumstances. The flags indicate which terminal a match was found for. (1= MATCH, 0=NO MATCH)
yes	yes	"EOF AFTER HEADER MISSING. PUSH START TO IGNORE".
yes	yes	"RDTRAN VERSION X LEVEL X BEGINS".

RDTRAN Errata (Cont'd)

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
no	yes	"ILLEGAL HISTORY CONTROL CHARACTER IT IS X CARD SKIPPED".
		H-History, R-Rework, and blank-original are the only legal history control characters.
yes	yes	"ERROR OCCURRED IN XXXXXXXX DATA OF P/N XXXXXXXXX E. C. No. XXXXXXXX CARD SHIPPED".
		This message is mainly to flag the part number of the card being skipped. An earlier message should state the reason.
no	yes	"ILLEGAL HEADER CONTROL CHARACTER. IT IS X CARD SKIPPED".
		The legal header control characters are as defined under header cards.
no	yes	"XXXXXX TABLE OVERFLOW. CARD SKIPPED."
		See ITEM 21 of RDTRAN program write-up for table limitations.
no	yes	"C MISSING AT START OF A CONTINUATION RECORD. CHARACTER IS X CARD SKIPPED."
		The first character of all but the first record of each small card must be a C.
yes	yes	"RDTRAN ENDS. XXX CARDS PROCESSED."
no	yes	"THIS DELETE CARD FOR A XXXXXX SIDE WIRE HAS NO CORRESPONDING ENTRY IN THE HISTORY DATA."
		This message is followed by a print-out of the segment in error.
no	yes	"INPUT CONTAINS XXX HAUTBOMDATE AND XXX HAUTBOMECN CARDS. CARD SKIPPED."
		There must be an equal number of these cards and for an original run it cannot exceed 1 of each and for an engineering change run, 2 of each are allowed.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
no	yes	"THE FOLLOWING XXXXXX SIDE WIRES HAVE A COMMON ENDPOINT BUT THEIR DOT CODINGS DO NOT AGREE." One segment is coded to a land the other is not.
no	yes	"IMPROPER TERMINATION OF XXXXX ENDPOINTS FOR THIS XXXXXX SIDE WIRE." Flags dangling line segment. Must be eliminated before release of EDT to SMD.
no	yes	"FOLLOWING IS A NET OF GREEN SEGMENTS CONTAINING MORE THAN ONE COMPONENT." This indicates that two or more components are trying to use the same co-ordinates.
no	yes	"THE FOLLOWING GREEN SEGMENTS ARE NOT ASSOCIATED WITH A COMPONENT." The segments listed are extraneous.
no	yes	"THESE WIRES HAVE A COMMON ENDPOINT BUT THE DOT CODING DOES NOT AGREE. FRONT WIRE LISTED FIRST BACK WIRE SECOND." One segment is coded to a land the other is not.
yes	yes	"NO DATA ON THE OUTPUT TAPE. PROGRAM WILL CALL EXIT."
no	yes	"PART NUMBER XXXXXXXXX EC NUMBER XXXXXXXXXX HAS BEEN PROCESSED."
yes	yes	"INPUT TAPE IS EITHER A HOLPAT OR RDTRAN OUTPUT TAPE. PROGRAM WILL CALL PROEX." If the input is not feed to 7090 it is not necessary to run RDTRAN. RDTRAN. RDTRAN will be skipped and the run will continue.

HOLPAT ON-LINE	OFF-LINE	MESSAGE AND EXPLANATIONS
yes	yes	*RECORD CONTROL CHARACTER ERROR. An illegal record control character has been unpacked while unpacking RDTRAN output.
yes	yes	ERROR(S) IN PN Errors have been found in the hole patter part number mentioned.
yes	yes	HOLE AT X = Y = IS AND COMPONENT REQUIRES. An illegal hole size exists at the X-Y given.
yes	yes	ASSEMBLY AND HOLE PATTERN CARD SIZES DISAGREE. The hole pattern card size disagrees with the assembly card size.
yes	yes	DELETING A NONEXISTENT HOLE. Trying to delete a nonexistent hole during a manual update.
yes	yes	NO HOLE AT X = Y = No hole at X-Y given.
yes	yes	LAND SPACING NOT VALID FOR MANUAL OR AUTOMATIC ASSEMBLY. According to ground rules the component lead spacing is invalid.
yes	yes	LESS THAN TWO LEAD CODES GIVEN FOR A COMPONENT WITH MORE THAN TWO LEADS. A component with more than two leads has less than two lead codes given in the green segments. The component is skipped.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	yes	ILLEGAL LEAD CODE USED. A lead code has been used that does not appear on the component library for that component.
yes	yes	ILLEGAL LEAD SPACING. The lead spacing given by the component library does not agree with assembly.
yes	yes	ILLEGAL ORIENTATION OR LEAD SPACING. The component orientation is illegal or because the two lead codes are wrong the lead spacing is in error.
yes	yes	COMPONENT LENGTH INVALID FOR MANUAL OR AUTOMATIC ASSEMBLY. The component length does not agree with ground rules.
yes	yes	LEAD DIAMETER INVALID FOR MANUAL OR AUTOMATIC ASSEMBLY. The lead diameter does not agree with ground rules.
yes	yes	EXTRANEOUS GREEN SEGMENT. A green segment has been found that does not go with a component.
yes	yes	COMPONENT WIDTH INVALID FOR MANUAL OR AUTOMATIC ASSEMBLY. The component width does not agree with ground rules.
yes	yes	COMPONENT LEAD DIAMETER INVALID FOR MANUAL OR AUTOMATIC ASSEMBLY. The component lead diameter does not agree with ground rules.
yes	yes	HOLE SIZE INVALID FOR MANUAL OR AUTOMATIC ASSEMBLY. Hole in card does not agree with ground rules.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	yes	ILLEGAL RUN STATUS CODE. WILL ASSUME CREATE. Program does not know whether the run is a use, change or create. It assumes create.
yes	yes	ILLEGAL RUN TYPE. WILL ASSUME AUTOMATIC. Program does not know whether the run is manual or automatic. It assumes automatic.
yes	yes	ILLEGAL RECORD CONTROL CHARACTER IN HOLE PATTERN MUST SKIP RECORD. During the reading of a hole pattern record an illegal record control character was read.
yes	yes	HOLE PATTERN NOT ON HISTORY. WILL ASSUME CREATE. The hole pattern called for is not on the library. Program assumes automatic create.
yes	yes	*P-TABLE OVERFLOW. MUST TERMINATE RUN. The table for P-date, or holes, has overflowed. Notify responsible programmer.
yes	yes	BEGIN UPDATING HOLE PATTERN HISTORY. Programs begin updating the hole pattern library.
yes	yes	UPDATING FINISHED. Updating of hole pattern library complete.
yes	yes	HOLE PATTERN PN ECN CALLED FOR. ECN ON TAPE IS WILL CONTINUE. The wrong level hole pattern tape is being used. Program ignores condition and continues.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	yes	*ILLEGAL RECORD CONTROL CHARACTER ON HISTORY SCRATCH TAPE. MUST TERMINATE RUN. An illegal character has been unpacked from the hole pattern scratch. Notify responsible programmer.
yes	yes	*END OF TAPE ON MUST TERMINATE JOB. Program has written to the end of the reel on the drive mentioned. Divide batch of small cards.
yes	yes	USING UNDEFINED LEAD CODE A lead code is being used that does not appear on the components tape.
yes	yes	INPUT DOES NOT ACCOUNT FOR LEAD. The input to HOLPAT does not account for the lead mentioned. In other words, the green segments for a component do not define a location for each lead on the component.
yes	yes	WILL NOT PROCESS. HOLPAT OUTPUT USED AS INPUT TO RDTRAN. The RDTRAN input tape has already been processed by HOLPAT.
yes	yes	ILLEGAL CHARACTER FOUND IN HOLE PATTERN RECORD. WILL SKIP RECORD. An illegal character was found in the hole record.

*These comments are accompanied by a termination of HOLPAT. The program calls PROEX, which will call the next program or give control back to the monitor.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	no	REDUNDANCY IN READING LABEL ON. REPLACE WITH COPY AND PRESS START. Redundancy in reading label on an input tape. Do as instructed.
yes	no	WRONG TAPE ON. CHANGE AND PRESS START. A wrong tape was mounted on the noted drive. Change to proper tape and press start.

HOLPAT Errata (Cont'd)

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	no	END OF TAPE NO EOF WRITTEN. MOUNT NEW REEL. PRESS START. End of FMS output tape has been reached. Mount new reel.

LILACK

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
yes	yes	INPUT TAPE TROUBLE. PUSH START TO TRY AGAIN.
yes	yes	HEADER DOES NOT HAVE - CA.DUP-DATE - PUSH START TO SKIP HEADER.
yes	yes	EOF MISSING AFTER HEADER. PUSH START TO GO ON.
yes	yes	C MISSING IN CONTINUATION RECORD. CARD SKIPPED.
yes	yes	(X) TABLE OVERFLOW. NOTIFY PROGRAMMER. CARD SKIPPED.
yes	yes	ILLEGAL HEADER CODE OR LINE SEGMENT COLOR. IT IS - (X).
no	yes	P CARD FOR (XXXbYYY)HAS UNKNOWN LAND SIZE. PROGRAM WILL USE .085 as LAND SIZE.
no	yes	LAND AT (XXXbYYY) AND LAND AT (XXXbYYY) ARE LESS THAN .040 APART.
no	yes	LAND AT (XXXbYYY) AND LINE AT (XXXbYYYbbXXXbYYY) INTERSECT. Flags dangling line segment. Must be eliminated before release of EDT to SMD.
no	yes	LAND AT (XXXbYYY) AND LINE AT (XXXbYYYbbXXXbYYY) ARE LESS THAN .010 APART.
no	yes	LINE AT (XXXbYYYbbXXXbYYY) LIES IN THE CARD EDGE RESTRICTED AREA.

ON-LINE	OFF-LINE	MESSAGE AND EXPLANATION
no	yes	LINE AT (XXXbYYYbbXXXbYYY) AND LINE AT (XXXbYYYbbXXXbYYY) INTERSECT. Flags dangling line segment. Must be eliminated before release of EDT to SMD.
no	yes	LINE AT (XXXbYYYbbXXXbYYY) AND LINE AT (XXXbYYYbbXXXbYYY) ARE LESS THAN .010 APART.
yes	yes	INPUT TOO BAD TO CONTINUE.
yes	yes	LAND AT (XXXbYYY) IS IN CARD EDGE RESTRICTED AREA.
yes	yes	END OF LILACK.
no	yes	LINE AT (XXXbYYYbbXXXbYYY) HAS ILLEGAL SLOPE.
no	yes	LINE AT (XXXbYYYbbXXXbYYY) HAS A (X) WIRE SIZE. PROGRAM WILL NOT CHECK THIS LINE.
yes	yes	INPUT READ ERROR. CARD SKIPPED.
yes	yes	BEGIN LINE CHECK ON P/N (XXXXXXXXX) E. C. (XXXXXXXXX).
no	yes	X LINE AT (XXXbYYYbbXXXbYYY) AND LINE AT (XXXbYYYbbXXXbYYY) OVERFLAP.

LILACX

"UNEXPECTED EOF READ PROGRAM MUST GO TO END OF JOB"

The program expected a data record but instead an end of file was read. The card in question will not be tested.

"NO EOF AFTER HEADER PUSH START TO IGNORE"

If start is pushed the input tape is backspaced and a normal run occurs.

"BEGIN LINE CHECK ON P/N XXXXXXXXX E. C. XXXXXXXXX"

LILACX Errata (Cont'd)

MESSAGE AND EXPLANATION

"END OF LILACX TESTS"

"ILLEGAL HEADER CODE OR LINE SEGMENT COLOR IT IS-X CARD SKIPPED"

The character specified (X) is not recognized by this program. This small card will not be checked.

"P TABLE OVERFLOW. CARD SKIPPED"

The maximum number of P cards which can be tabled is 2000. This small card will not be processed.

"C MISSING IN CONTINUATION RECORD. CARD SKIPPED"

The first record of each card must start with a blank and all other records with a C. This card will not be tested.

"ILLEGAL LAND CODE. FRONT (X) BACK (X) COORDINATES XXX YYY THE LAND WILL NOT BE CHECKED."

The land code specified is not known. The program will not check this land.

"LILACX VERSION X LEVEL X BEGINS"

The version and modification level is printed at the beginning of each run.

"LINE AT XXX YYY XXX YYY HAS ILLEGAL SLOPE"

Horizontal, vertical and 45° lines are the only legal wires. The line specified will not be checked for any other type of error.

"LINE AT XXX YYY XXX YYY HAS A (X) WIRE SIZE. PROGRAM WILL NOT CHECK THIS LINE"

"XX MIL LAND AT XXX YYY XXX YYY AND FRONT SIDE XX MIL LINE IN NET XXXX BACK AT XXX YYY XXX YYY ARE TOO CLOSE"

MESSAGE AND EXPLANATION

"FRONT-BACK SIDE WIRE AREA IS XXXXXXX XXXXXX SQUARE INCHES"

The length of each segment is multiplied by the wire width and summed.

"FRONT-BACK XX MIL LINE IN NET XXXX AT XXX YYY XXX YYY AND XX MILE LINE IN NET XXXX AT XXX YYY XXX YYY INTERSECT"

Flags dangling line segment must be eliminated before EDT is released to SMD

"FRONT-BACK XX MIL LINE IN NET XXXX AT XXX YYY XXX YYY AND XX MIL LINE IN NET XXX YYY XXX YYY OVERLAP"

"FRONT-BACK XX MIL LINE IN NET XXXX AT XXX YYY XXX YYY AND XX MILE LINE IN NET XXXX AT XXX YYY XXX YYY ARE TOO CLOSE"

ALDCOP

Halts

INCORRECT FORMAT ON HOLPAT TAPE MOUNT NEW TAPE ON B2 AND PUSH START

Tape B2 does not have correct header label.

NO HEADER ON B5 MOUNT FACTORY RELEASED TAPE ON B5 AND PUSH START

Tape B5 does not contain header label.

END OF TAPE ON A3, MOUNT NEW TAPE - PUSH START

Comments tape is full

Messages

CANNOT PROCESS ALL CARDS FOUND ON HOLPAT TAPE WILL CONTINUE WITH THE FIRST 50 CARDS

Maximum number of cards that can be processed is 50.

ALDCOP Errata (Cont'd)

MESSAGE AND EXPLANATION

END OF TAPE ON A7--JOB TERMINATED

Cannot use multi-reel scratch tape

REDUNDANCY ERROR ON HOLPAT TAPE--
JOB TERMINATED

Cannot read input tape

ALDCOP2

BEGIN PROCESSING PART NO. XXXXXXXXX
E. C. NO. XXXXXXXX

Printed at start of processing for each card.

NO PAGES FOUND ON LMT.

Page count for this card on control card tape is zero. No ALD will appear on EDT for this card.

ALD IMAGE CANNOT BE FOUND ON THE
IMAGE TAPE

Page count from control tape indicates that this page was on LMT but it is not on the image tape. No ALD will appear on EDT for this card.

ALD PART NO. XXXXXXXXX DOES NOT
AGREE WITH HOLPAT PART NO. XXXXXXXXX

The part number extracted from the ALD image is not the same as the part number from control card tape. No ALD will appear on EDT for this card.

HOLPAT E. C. XXXXXXXXX DOES NOT
AGREE WITH ALD E. C. XXXXXXXX

E. C. No. extracted from the ALD image is not the same as the E. C. No. from the control card tape. No ALD will appear on EDT for this card.

RUN NUMBER FROM THE HLOG NUMBER CARD
IS--XXXX RUN NUMBER FROM THE ALD
IMAGE TAPE IS--XXXX

These are printed for each card but are not compared by the program.

ALDCOP2 Errata (Cont'd)

MESSAGE AND EXPLANATION

END OF TAPE DETECTED ON OUTPUT TAPE--CANNOT CONTINUE

Cannot handle multi-reel output

****THIS ALD WILL NOT APPEAR ON THE OUTPUT TAPE****

Printed for each card that contains any of the above errors that cause the ALD to be deleted from EDT.

ALDCOP PART 2 IS FINISHED

Printed at end of program

Halts

ERROR READING A7--PUSH START

Tape error

INCORRECT TAPE ON A7--MOUNT NEW TAPE AND PUSH START

Tape is not the selection card tape created by ALDCOP

MESSAGE AND EXPLANATION

AUTBOM

COMPONENT IS SMALLER THAN .375 CENTER TO CENTER.

This message is followed by 22 characters of information which is the component information as it should have been placed. This message refers only to horizontal components. The minimum center to center lead spacing for vertical components is .550 inches.

CANNOT PLACE ALPHA INFO IN COMPONENT NUMBER (NO.) ALPHA INFO FOLLOWS

Component number and code immediately follows this statement. This information should be shipped to Dept. 146, Endicott, so that the drawing can be completed correctly.

ILLEGAL COMPONENT TYPE ____
COMPONENT HAS BEEN IGNORED

ILLEGAL LEAD CODE OR ILLEGAL ORIENTATION PART NUMBER ______

An offset component cannot be drawn correctly due to an error in the lead codes or orientation.

ERROR READING TAPE B2 PRESS START TO TRY AGAIN - IXIT - Z

Z can equal 1 EOF detected (unexpected)
2 Tape check error
5 Record too large for 1500 word buffer

Input tape must be rebuilt.

IF THIS RUNS FROM HISTORY TAPE PLACE SSW_2 DOWN AND PUSH START IF NOT SOMETHING GOOFED MARK DOWN STOP AND PULL JOB.

MESSAGE AND EXPLANATION

AUTWIR

ILLEGAL CONTROL CHARACTER

Something is wrong unpacking input tape card skipped

ILLEGAL END OF FILE FOUND

End of file where not expected. Program has been dumped automatically. Operator should have tape B2 dumped using LIDUMP with SSW A, B, and C on.

THE NOTE TABLE HAS OVERFLOWED

More than 90 notes on this small card. Excess ones are skipped.

BAD OUTPUT TAPE ON LOGICAL DRIVE NN
MOUNT NEW TAPE AND RESTART JOB

If NN is the logical number of the E. D. T., the output tape containing the E. D. T. has a bad spot, and the ENGDES Program will have to be completely restarted. Another factory released tape should be pulled from the library and mounted on the output tape drive. If no other factory released tapes are readily available, the present output tape may be stripped, a new factory release lable written on it, and then placed back on the output tape drive. A factory release label that will permit processing to proceed would be:

"1HDRb TTTTT (-000b-000b)
FACRELTAPE bbb. . ."

where TTTTT is the tape serial number

MESSAGE AND EXPLANATION

ENGDUM

TAPE LABEL DOES NOT CHECK, EDT SHOULD BE ON B5. PLEASE CHECK. PRESS START TO TRY AGAIN.

TAPE FORMATS

RDTRAN INPUT & HOLPAT OUTPUT

```
File 1 - 80   CHARACTER HEADER LABEL
 "   2 - 2004     "     RECORDS
 "   3 - 80       "     TRAILER LABEL
```

EDT

```
FILE 1 - 80   CHARACTER HEADER LABEL
 "   2 - 1800     "     RECORDS
 "   3 - 80       "     TRAILER LABEL
```

SCOPE

The Card History Tapes (CHT) at each location contain the latest level circuit card information produced from their CCDA runs. The CHT is used to generate EDTs with or without changes processed against it.

INPUT

The HOLPAT Output Tapes (HOT) produced from CCDA runs and the latest level CHT.

PROGRAMS

MERDEL

A 1401-12K program used to:

a. Merge one or more HOT's or specific cards on a HOT with a CHT.
b. Delete cards from either the CHT or HOT.

MERDEL is limited to creating and updating a single reel of card history. MERDEL can process multiple HOT's sequentially, provided that the cards on these tapes taken as a whole are sequenced by part number. Approximate running time is 20 minutes. If two output tapes are produced, the time will be increased by one-third.

SET-UP/PROCESSING

Update Mode

Deck

a. Atlas Call Card - This card is omitted if the program deck is used.

b. Date Card

Column	Data
1-4	"Date"
7-9	Month (Jan, Feb, etc.)
11-12	Day (Ø1, Ø2, etc.)
14-17	Year (1965, 1966, etc.)
20-24	I/P reel number
26-30	O/P reel number

SET-UP/PROCESSING (continued)

c. Delete Card - This card(s) is used when a part number(s) on the HOT is not wanted on the CHT. Up to 18 cards may be used.

Column	Data
1-10	Blank
11-19	Card P/N to be deleted (right adjusted)
20	, (comma)
21-29	Next card P/N to be deleted
30	, (comma)
31-39	Next card P/N to be deleted
40	, (comma)
41-49	Next card P/N to be deleted
50	, (comma)
51-59	Next card P/N to be deleted

d. EOF Card

Column	Data
1	7/8 punch

Tape Assignments

Drive	Tape
2	Copy of new CHT (optional)
3	HOT (mounted in ascending part number order if processing sequential HOTs)
4	Old CHT
5	New CHT
6	ATLAS (optional)

SET-UP/PROCESSING (continued)

Sense Switch Options

A	ON	
B	ON	- One new CHT will be produced on drive 5
	OFF	- A new CHT will be produced on drive 2 and 5
C	ON	- Bypasses header check
	OFF	- Allows operator to restart on header check
D	ON	- Multiple input HOT merge
	OFF	- Single input HOT merge
E	ON	- Terminates multiple HOT run in Input Mode
	OFF	- Automatically merges next HOT
G	ON	- Delete Mode
	OFF	- Update Mode

Delete Mode

Deck

a. Atlas Call Card - This card is omitted if the program deck is used.

b. Date Card - Use the same format as the Update Mode.

c. Delete Card - Normally this mode is used to delete card part numbers from a CHT, but it can also be used to delete card part numbers from a HOT by using sense switch C. Use the same format as the Update Mode.

d. EOF Card

Column	Data
1	7/8 punch

Tape Assignments

Drive	Tape
2	Copy of new CHT (optional)
3	Old CHT
5	New CHT
6	ATLAS (optional)

SET-UP/PROCESSING (continued)

Sense Switch Options

None.

OUTPUT

Update Mode

Documents - The following on-line lists:

a. Record count was XXXX is XXXX now.

b. There were XXXX part numbers, there are now XXXX part numbers.

c. These part numbers were not found on the HOT. (This is printed out when part numbers are trying to be deleted from the HOT.)

d. The part and E.C. number(s) of the card(s) being added and/or replaced on the CHT.

Tapes - One or two updated CHTs depending on sense switch option.

Delete Mode

Documents - An one line list of the P/Ns copied onto the new CHT, deleted, and requested but not on the old CHT.

Tapes - Same as Update Mode.

Errata

Halts

a. UNEXPECTED TAPE ON LOG X. IT IS XXXXXXXXXX
MOUNT CORRECT TAPE AND START OR ELSE
SS C ON AND HIT START TO CONTINUE

Either mount the correct tape on logical X and hit start or put sense switch C on and hit start to continue processing if the tape on logical X is the desired tape.

b. READ CHECK ON UPDATE TAPE
HIT START TO TRY AGAIN

Hit start to try to read the update tape 40 more times.

OUTPUT (continued)

Halts

c. READ CHECK ON HISTORY TAPE
HIT START TO TRY AGAIN

Hit start to try to read the history tape 40 more times.

d. WRITE CHECK ON NEW HISTORY
HIT START TO TRY AGAIN

Hit start to skip and blank tape and to try and write the new history tape 40 more times.

e. EOR ON NEW HISTORY

New history tape had exceeded one reel. Return to control center.

f. MOUNT NEXT UPDATE TAPE OR SS E ON TO END - START

This message occurs if the program is in multiple input mode (SSD on) when the program has completed merging an update tape. Mount the next update tape on logical 3 or if there are no more, put sense switch E on. Hit start to continue processing.

g. PUT CSTEST OBJECT DECK IN CARD READER
PRESS START TO LOAD CSTEST

This halt occurs when the option to run the cost estimate program is exercised. Load cost estimating program from cards or from ATLAS.

h. HISTORY REEL NO. IS XXXXX AND SHOULD BE XXXXX
MOUNT CORRECT TAPE AND START OR ELSE,
SS C ON AND HIT START TO CONTINUE

Same as halt a.

i. END OF JOB

The program has successfully terminated.

Messages

a. UPDATE RECORDS ARE NOT PROPERLY SEQUENCED
P.N. XXXXXXXXXX WAS NOT PUT ON THE NEW HISTORY

This part number was skipped in the merge because it was out of sequence.

OUTPUT (continued)

Messages

b. INSERTED PART NO. XXXXXXXX E.C. XXXXXXXX

This part number was merged onto the history tape.

c. REPLACED PART NO. XXXXXXXX E.C. XXXXXXXX

This part number has replaced the previous level on the history tape.

d. P.N. XXXXXXXX WAS NOT PUT ON THE NEW HISTORY

This part number was deleted from the merge.

e. RECORD COUNT WAS XXXXX RECORD COUNT IS NOW XXXXX

This message gives the record count of the old and new history tapes.

f. THESE P.N.'s WERE NOT FOUND ON THE INPUT TAPE XXXXXXXXX

The part numbers listed under this message were specified in delete cards to be deleted but were not found on the input tape.

CHT FORMAT

File 1 - 80 character tape header label

File 2 - 2004 character records

File 3 - 80 character tape trailer label

DECK

EOF CARD

DELETE CARD(S)

DATE CARD

ATLAS CALL CARD OR PROG. DECK

ATLAS

6

Old CHT or HOT

3

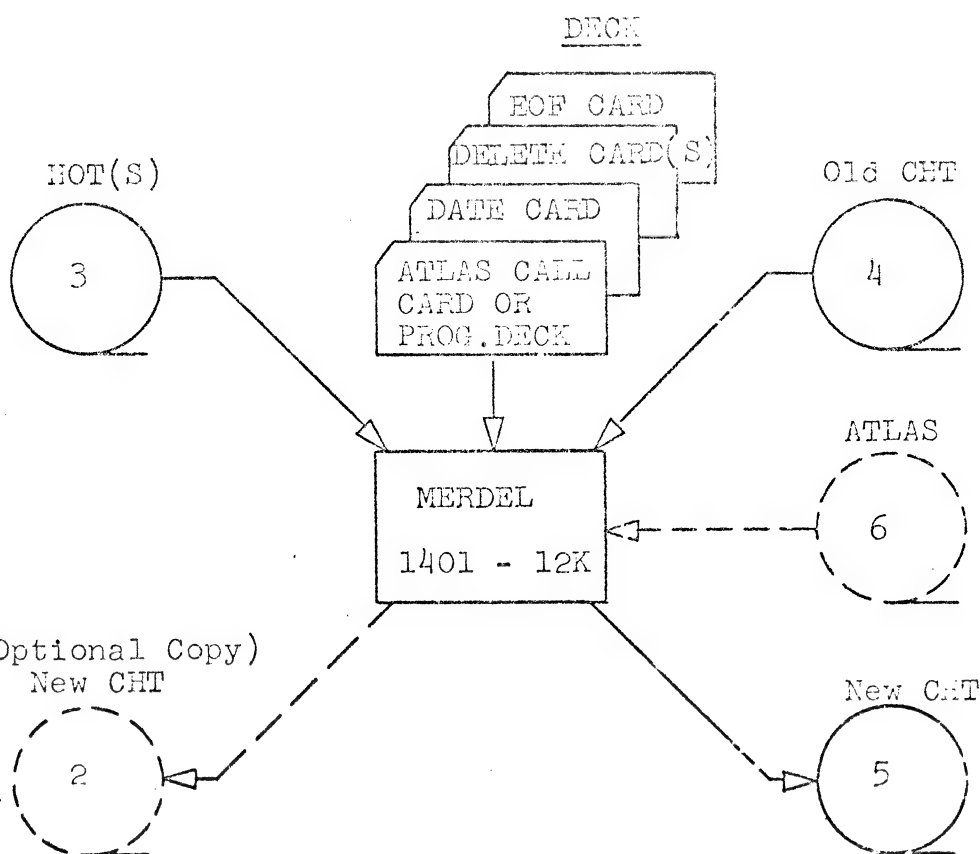
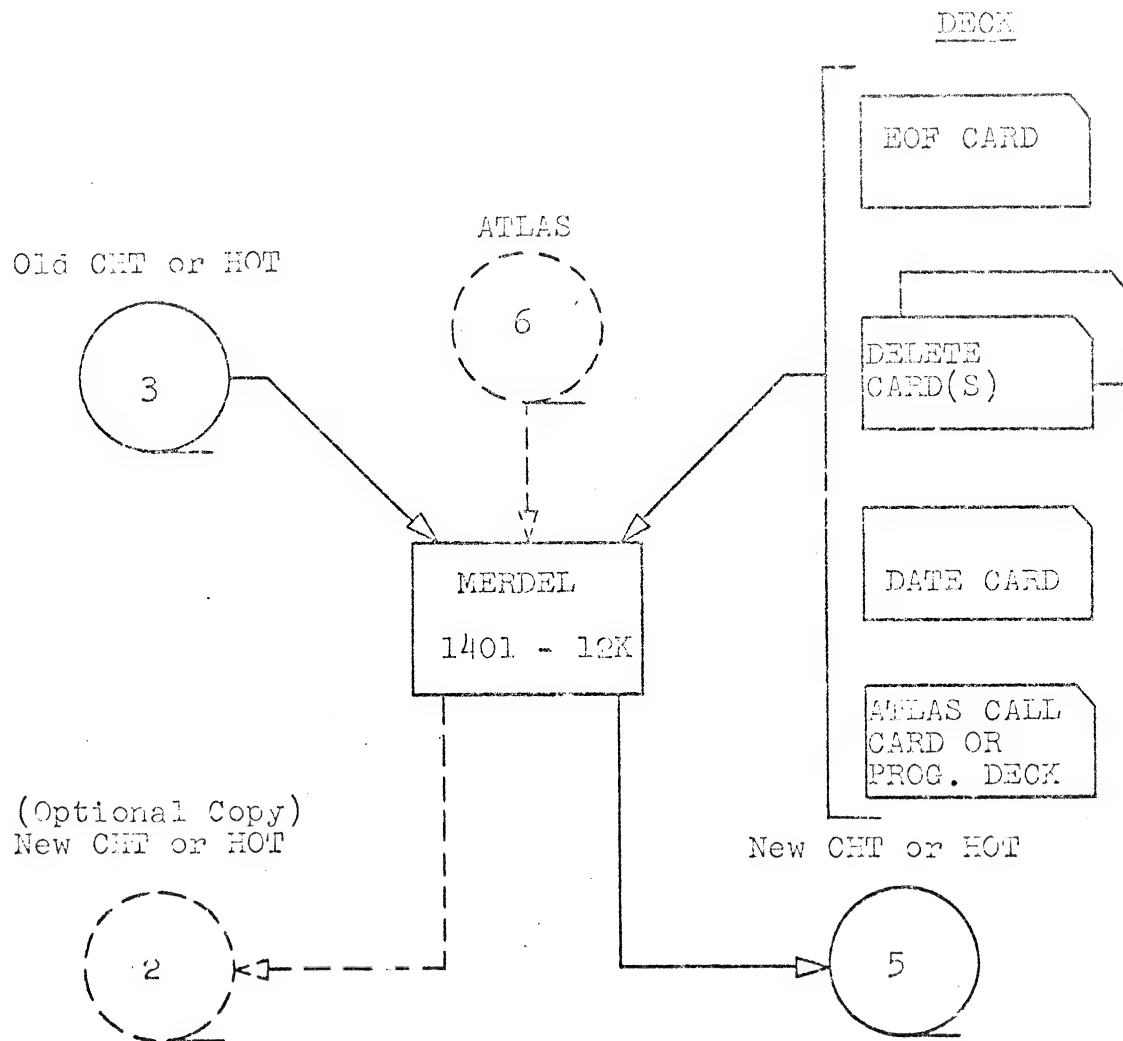
MERDEL

1401 - 12K

(Optional Copy) New CHT or HOT

2

New CHT or HOT

5

DATA FLOW WITH MERDEL IN DELETE MODE

SCOPE

This suffix covers the requirements for Standard Flat Cable Card Design and Layout.

TABLE OF CONTENTS

DEFINITION

The term "cable card" is a general name given to any form of card which connects to a cable and thereby allows signals to be transferred from one socket position to another. In this section of the ground rules the term "cable card" will be used to refer to a specific class or type of cable card. This type of cable card connects, or terminates, a standard SLT Flat Cable only.

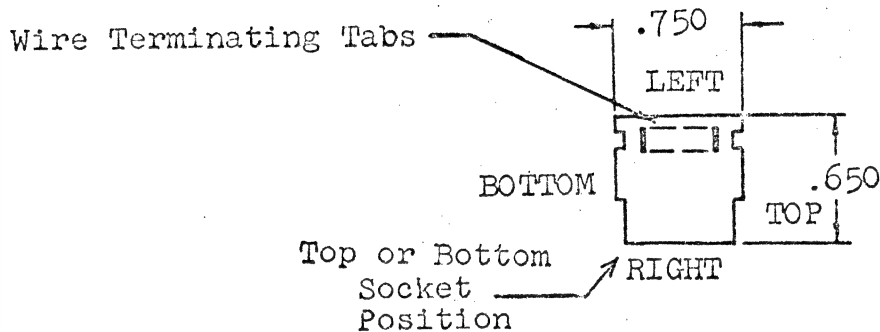
Cards which are used as terminators for forms of discrete wire, twisted pair, triple twist, woven, braided, or discrete wire flat ribbon etc. are referred to as "discrete wire" type cable cards and will not be covered within this section of the ground rules.

Cable card types, which are covered within this section, will be referred to as one of these (See Figure 1): (a) standard, (b) crossover, (c) R/Pac, and/or (d) specials. Cable Card types "a" and "b"(standard and crossover) can be broken down into sub-types; these are full and half-width. Half-width cards are also referred to as being of either slow speed or high speed size. A standard cable card can, at times, serve a dual function - it can be both a standard card as well as a crossover or special card. This will become evident as one becomes familiar with existing cable cards as well as cable card layout and design.

For use in cable assembly design and routing, several electrical speed categories exist for cable cards. These categories are (a) slow speed - which includes both the 700 and 30 nanosecond families, (b) hi-speed - which is the 5 nanosecond family, and (c) other - which includes such areas as I/O points and cables which require special ground shielding patterns.

Individual contact tab signal/voltage-ground configurations (spring contact tabs which connect to board pins) for the slow speed family are shown in Figures 2 and 4. Figure 2 shows the full width pin configuration while Figure 4 shows the half-width pin configuration. The hi-speed family full and half width pin designations are found on Figures 3, 5, and 6. Other pin designations are generally supplied by the user when requesting the layout of a special card. Figures 2 through 6 also show the maximum signals which can be transferred between various board columns and positions.

Special signal transfer techniques are used when designing cable cards which are used to transfer signals on half-width hi-speed type cards between top and bottom positions. Except where noted as "no trans" all cable cards are designed to transfer signals on a point to point basis e.g. D02 to D02, B05 to B05, etc. , in other words "D" row to "D" and "B" row to "B". Positions marked "no trans" on Figures 5 and 6 invert the signals, e.g. B09 to D03, B10 to D04, etc. in other words "D" row to "B" and "B" row to "D".

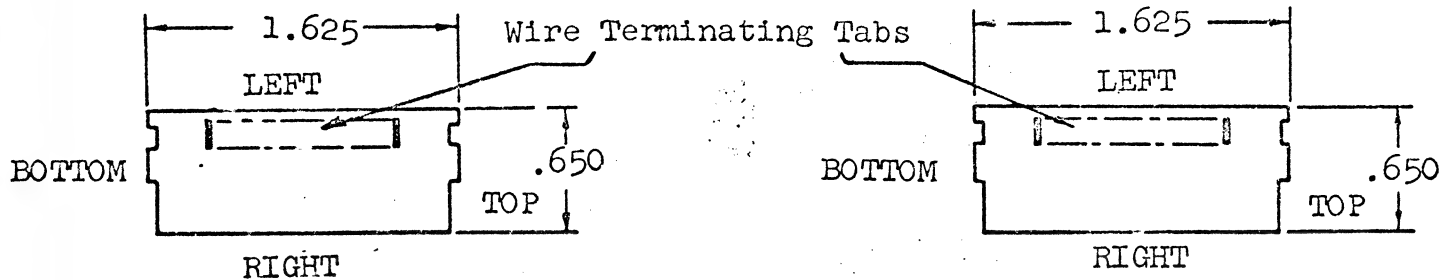
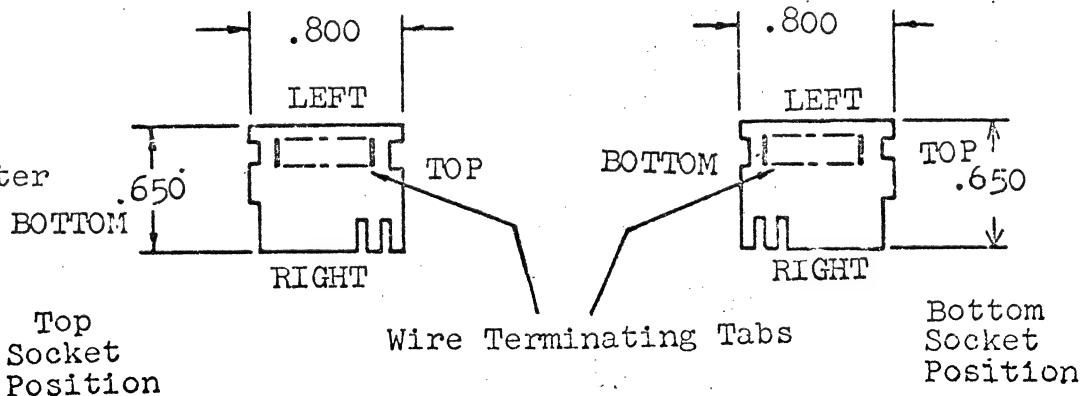
Wire Terminating Tabs
.750
LEFT
BOTTOM
.650
TOP
RIGHT
Top or Bottom Socket Position

STANDARD
(Half Width)
low-speed
Max.9 Signals
on .054 Centers

Half-width
Hi-speed
Max 9 Sig
on .054 Center

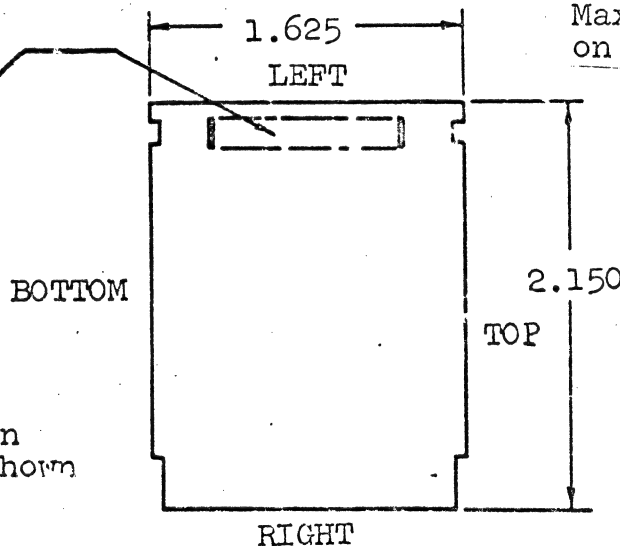
.800
LEFT
.650
BOTTOM
TOP
RIGHT
Top Socket Position

.800
LEFT
BOTTOM
TOP
.650
RIGHT
Bottom Socket Position

Wire Terminating Tabs

1.625
LEFT
BOTTOM
.650
TOP
RIGHT
Wire Terminating Tabs
1.625
LEFT
BOTTOM
.650
TOP
RIGHT

Low Speed Crossovers
(Full Width)
Max. 22 Signals
on .042 Centers

Standard and/or
Hi-speed Crossover
Max 20 Signals
on .054 Centers

1.625
LEFT
Wire Terminating Tabs
BOTTOM
2.150
TOP
RIGHT

R/PAC CABLE
Card. Max 20
Signals on
.054 Centers

SPECIAL - Any Variation
of configurations shown

SINGLE PLANE FLAT CABLE CARD TYPES (FRONT VIEW)

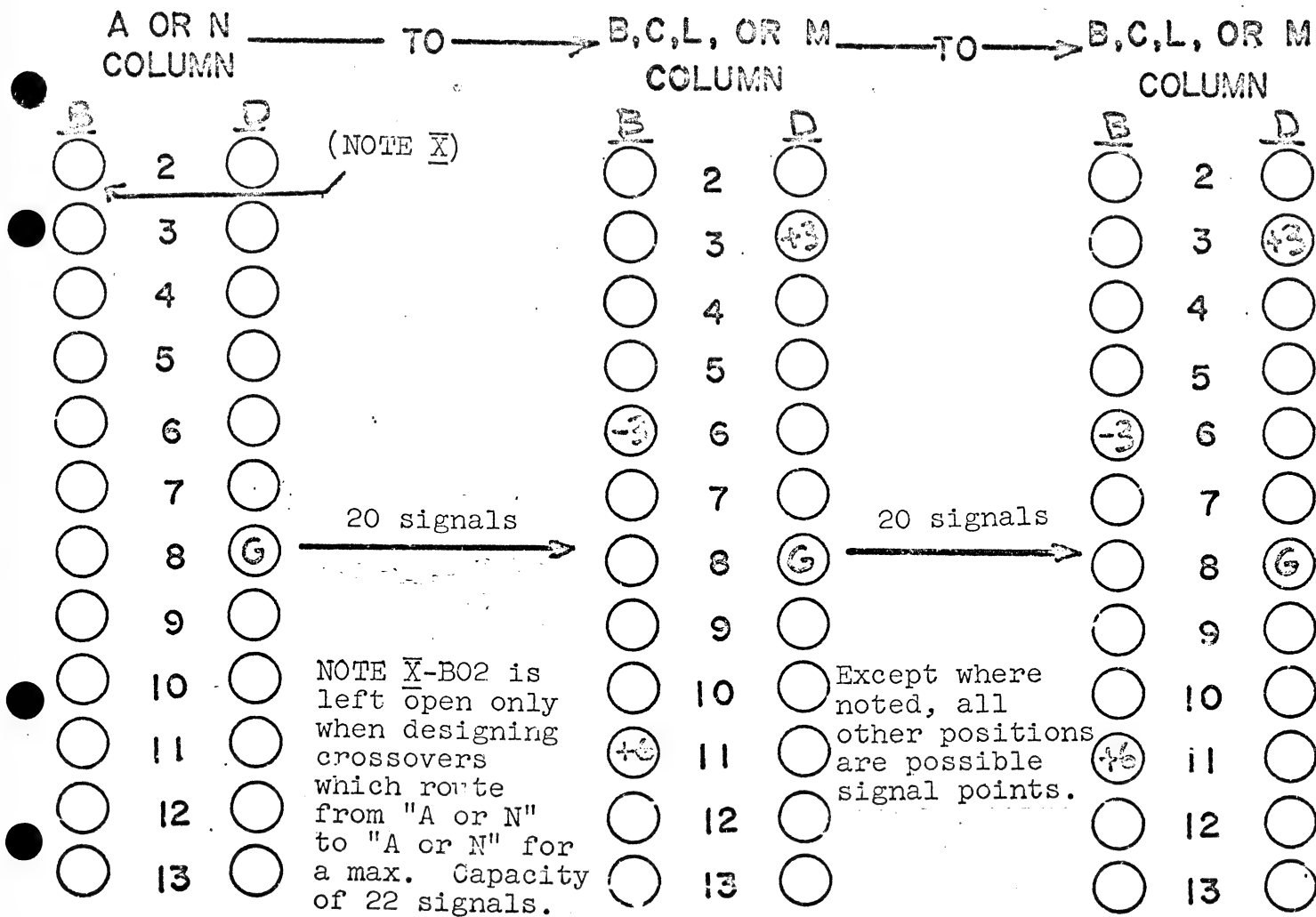
FIG 1

A OR N COLUMN —— TO ——> B, C, L, OR M COLUMN —— TO ——> B, C, L, OR M COLUMN

B		D		B		D		B		D
○	2	○		○	2	○		○	2	○
○	3	○		○	3	+3		○	3	+3
○	4	○		○	4	○		○	4	○
○	5	○		○	5	○		○	5	○
○	6	○		-3	6	○		-3	6	○
○	7	○		○	7	○		○	7	○
○	8	G	20 signals →	○	8	G	20 signals →	○	8	G
○	9	○		○	9	○		○	9	○
○	10	○		○	10	○		○	10	○
○	11	○		+6	11	○		+6	11	○
○	12	○		○	12	○		○	12	○
○	13	○		○	13	○		○	13	○

(NOTE X) → B 2

NOTE X-B02 is left open only when designing crossovers which route from "A or N" to "A or N" for a max. Capacity of 22 signals.

Except where noted, all other positions are possible signal points.

CABLE COLUMN SIGNAL & GROUND/VOLTAGE LOCATIONS

FULL WIDTH - SLOW SPEED (700 & 30 NS)

FIG. 2

A OR N COLUMN —— TO ——> B,C,L, OR M COLUMN —— TO ——> B,C,L, OR M COLUMN

A or N column:

B		D
○	2	G
○	3	○
○	4	○
○	5	○
○	6	○
G	7	○
○	8	G
○	9	○
○	10	○
○	11	○
○	12	○
G	13	○

17 Signals ——>

B, C, L, or M column:

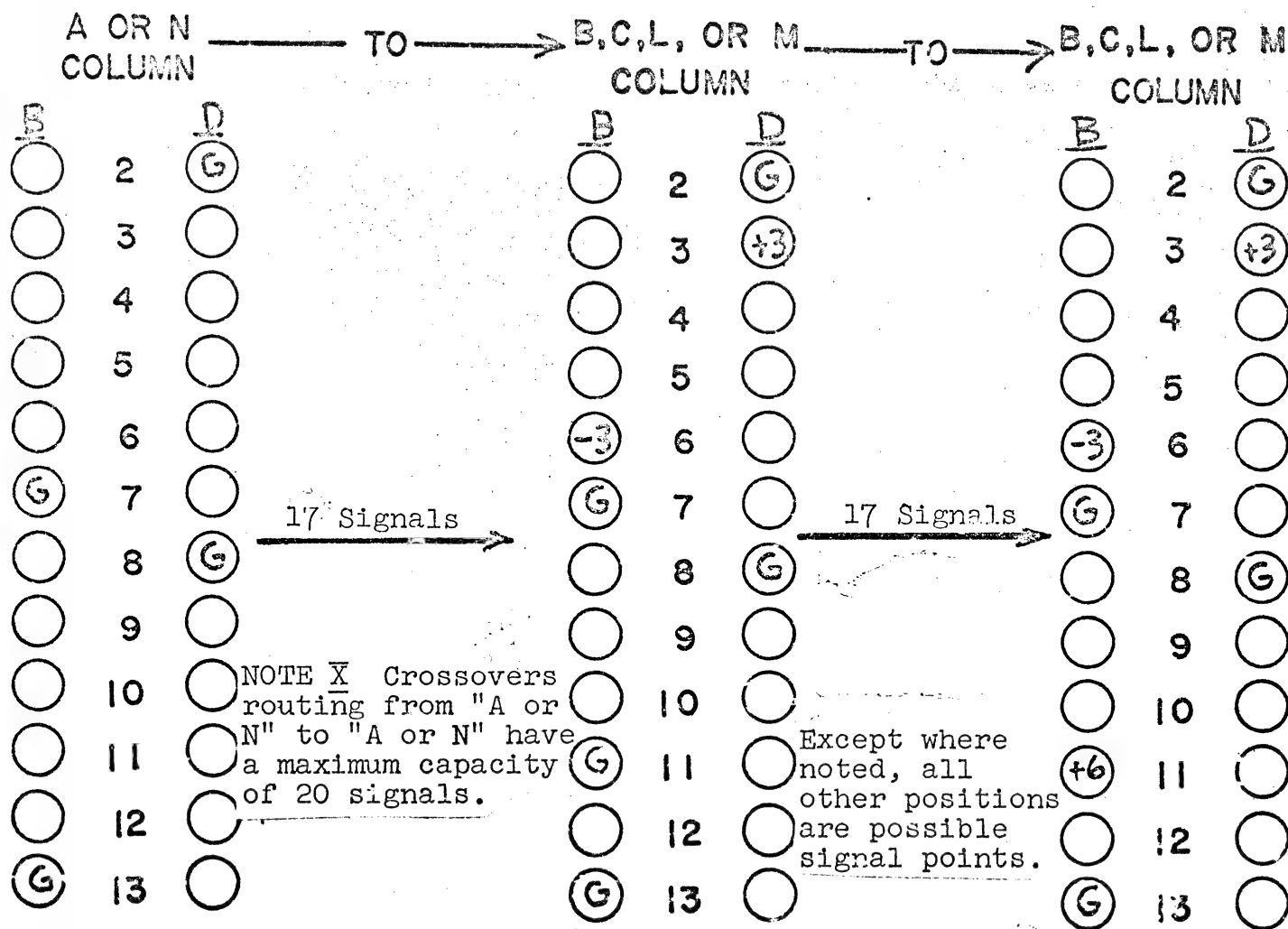
B		D
○	2	G
○	3	+3
○	4	○
○	5	○
-3	6	○
G	7	○
○	8	G
○	9	○
○	10	○
G	11	○
○	12	○
G	13	○

17 Signals ——>

B, C, L, or M column:

B		D
○	2	G
○	3	+3
○	4	○
○	5	○
-3	6	○
G	7	○
○	8	G
○	9	○
○	10	○
+6	11	○
○	12	○
G	13	○

NOTE X Crossovers routing from "A or N" to "A or N" have a maximum capacity of 20 signals.

Except where noted, all other positions are possible signal points.

CABLE COLUMN SIGNAL & GROUND/VOLTAGE LOCATIONS

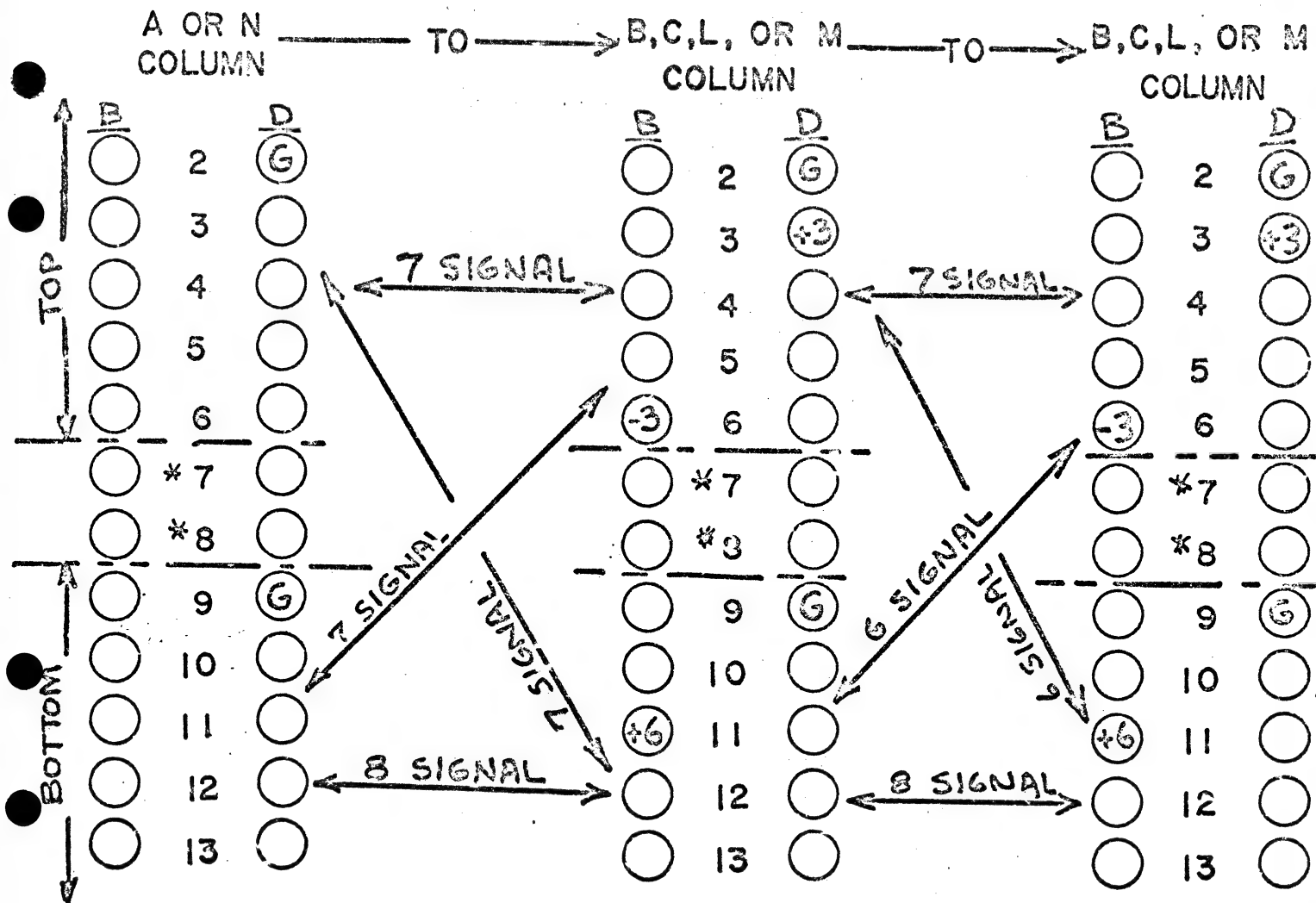
FULL WIDTH - HI SPEED (5 NS)

FIG 3

A OR N COLUMN —— TO ——> B,C,L, OR M COLUMN —— TO ——> B,C,L, OR M COLUMN

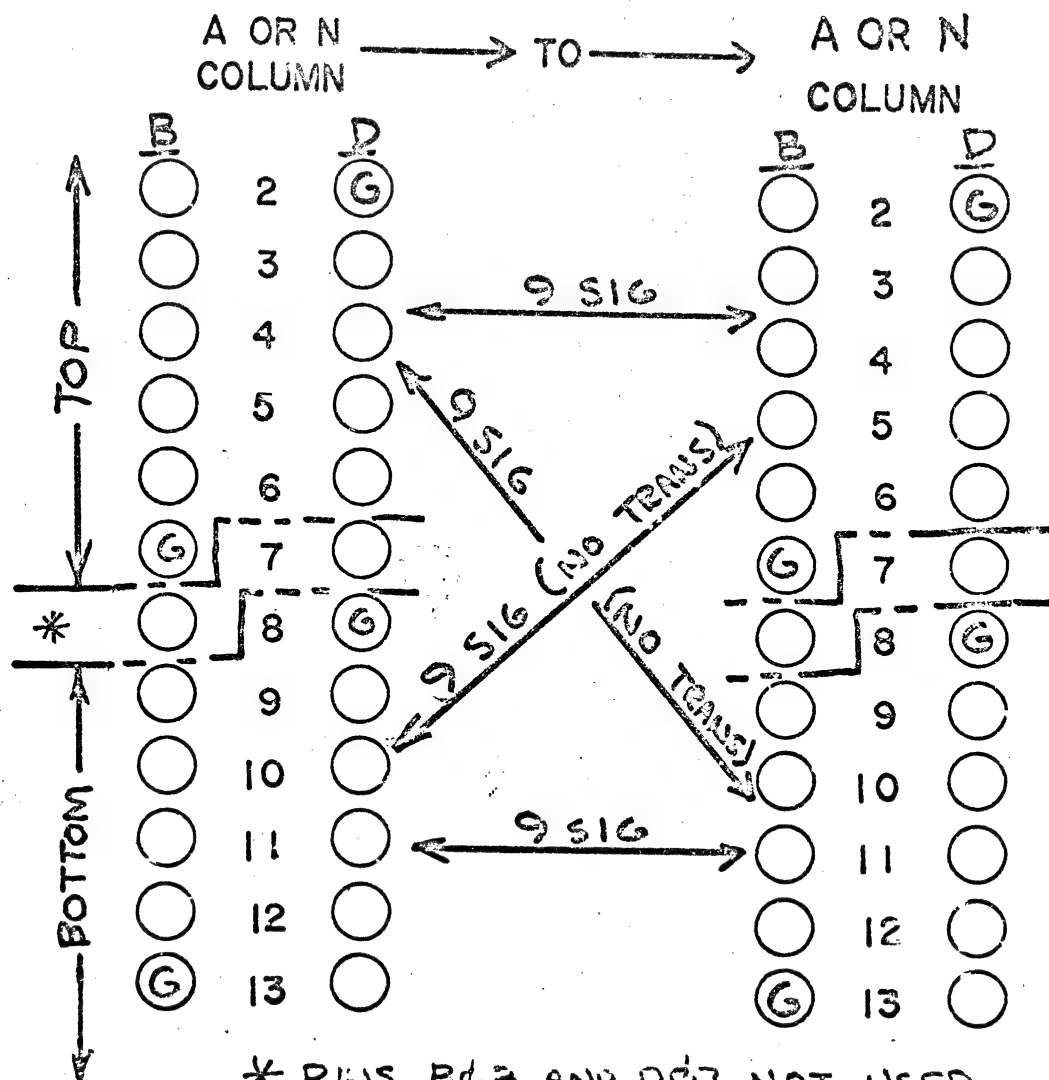
B		D		B		D		B		D
○	2	G		○	2	G		○	2	G
○	3	○		○	3	+3		○	3	+3
○	4	○		○	4	○		○	4	○
○	5	○		○	5	○		○	5	○
○	6	○		-3	6	○		-3	6	○
○	*7	○		○	*7	○		○	*7	○
○	*8	○		○	*8	○		○	*8	○
○	9	G		○	9	G		○	9	G
○	10	○		○	10	○		○	10	○
○	11	○		+6	11	○		+6	11	○
○	12	○		○	12	○		○	12	○
○	13	○		○	13	○		○	13	○

TOP (pins 2–6); BOTTOM (pins 9–13)

7 SIGNAL; 7 SIGNAL; 7 SIGNAL; 8 SIGNAL; 7 SIGNAL; 6 SIGNAL; 6 SIGNAL; 8 SIGNAL

CABLE COLUMN SIGNAL & GROUND/VOLTAGE LOCATIONS

HALF WIDTH - SLOW SPEED (700 & 30 NS)

*NOTE: PINS 7 & 8 NOT USED

FIG. 4

CABLE COLUMN SIGNAL & GROUND/VOLTAGE LOCATIONS

HALF WIDTH - HI SPEED (5 N.S.)

FIG 6

A OR N COLUMN —— TO ——> B, C, L, OR M COLUMN —— TO ——> B, C, L, OR M COLUMN

B D 2 3 4 5 6 7 8 9 10 11 12 13

G *3 -3 * G -6

7 SIGNAL

8 SIG

6 SIG

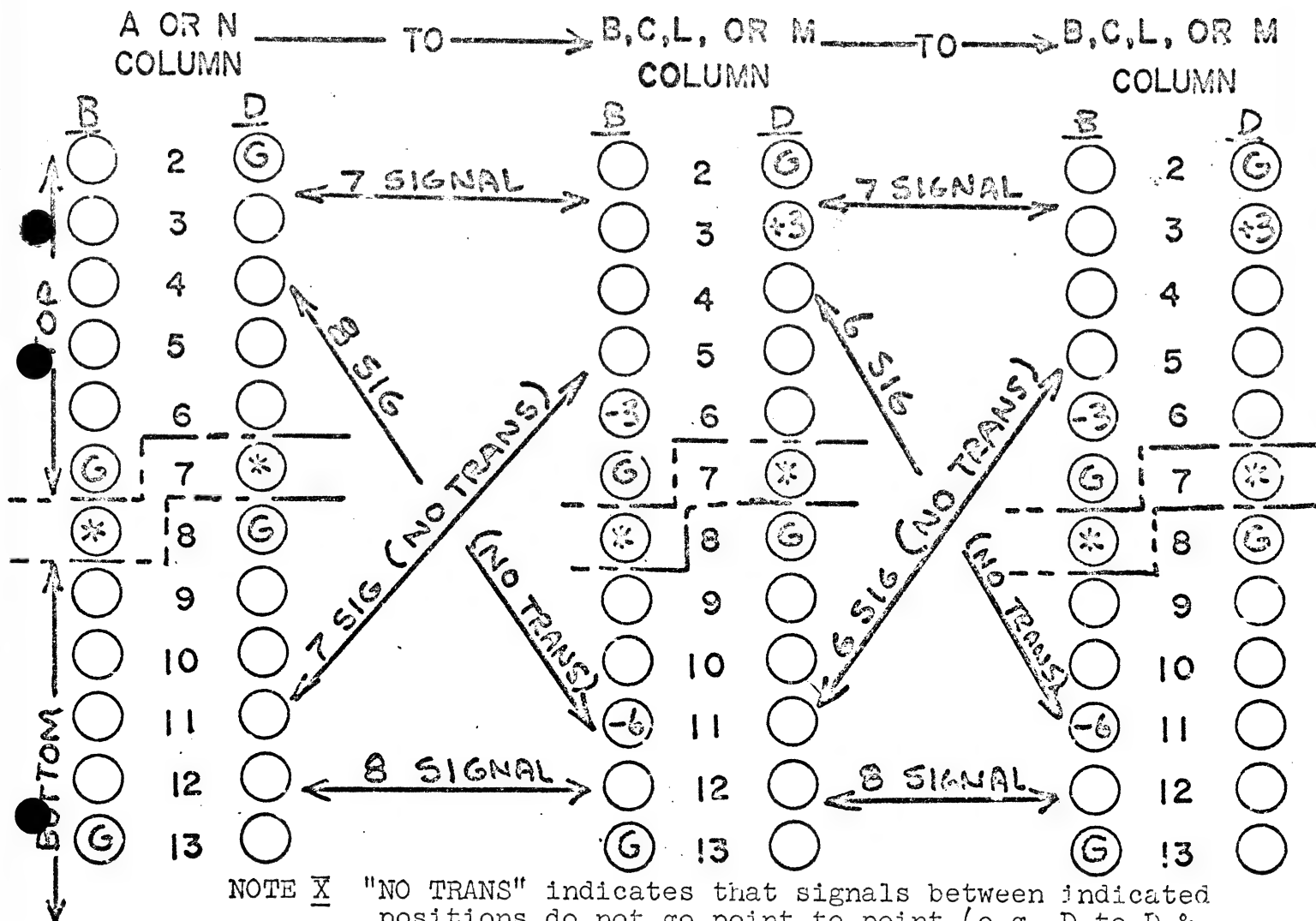
7 SIG (NO TRANS)

6 SIG (NO TRANS)

(NO TRANS)

8 SIGNAL

TOP

BOTTOM

NOTE X "NO TRANS" indicates that signals between indicated positions do not go point to point (e.g. D to D & B to B), instead they go B to D & D to B)

CABLE COLUMN SIGNAL & GROUND/VOLTAGE LOCATIONS

HALF WIDTH - HI SPEED (5 N.S.)

* NOTE: PINS BØ8 & DØ7 ARE NOT USED

FIG. 5

DEFINITION (CONTINUED)

This inversion of signal transfer is done in order to obtain the maximum amount of signals transferrable between two socket positions in the indicated direction.

GENERAL CABLE CARD INFORMATION

Existing cable card sizes are shown in Figure 1. These card sizes are:

(a) .650 high x 1.625 wide (standard full)

(b) .650 high x .750 wide (slow-speed half)

(c) .650 high x .800 wide (hi-speed half)

(d) 2.150 high x1.625 wide (R/Pac)

Wire terminating tabs for the above type cards fall into two possible signal wire spacing configurations.

These are:

(a) .054 signal wire centers

20 signal maximum capacity used with card size "a" and "d" above. These types terminate 20 signal wires to individual tabs on the front and 40 ground wires commoned to ground on the back side.

9 signal maximum capacity - used with card sizes "b" and "c" above. These types terminate 9 signal wires to individual tabs on the front and 18 ground wires commoned to ground on the back side.

(b) .042 signal wire centers

22 signal maximum capacity - used with card size "a" as a slow speed crossover only. This type terminates 22 signals to individual tabs on the front side and 23 ground wires commoned to ground on the back side.

Wire terminating tab locations on cable cards for above wire centers are to be in accordance with Engineering Specification 890911.

STANDARD CARD

Note: Dimensions given within this section are unit size dimensions. Any other dimensions given will show magnification along side the figure. e.g. .100 (4x) i.e. the .100 dimension is shown as 4 times size; it would be .025 unit size.

General layout and design parameters to be considered prior to design of cable cards are:

Physical Parameters -

1. All tabs on back side of cable cards are to be connected to ground.

2. All tabs on front side of cable card are to be connected to signals.

3. Hole size - plated through and in accordance with Logic Card Ground Rules for "J" size holes.

4. Land size - circular and in accordance with Logic Card Ground Rules for "J" size lands.

5. Signal, Voltage, and Ground lines - same size as used in the design of manual card (See Suffix 3)

6. Spacing Conditions:

   a. Land to line and line to line - in accordance with Logic Card Ground Rules.

   b. Land to land - same spacing conditions as used in "a" above.

7. Land/hole location restrictions:

   a. Center line of lands with "J" holes cannot be located lower than Y grid 21.

   b. "J" holes must not be designed into a hole pattern so as to allow less than .040" between adjacent holes or hole edges and card edge.

   c. Cards must be designed so that lands exist on grid 23-23 and 78,23. Where lands are not functionally required in one or both of these positions, see section under "Artworks - Cable Card."

d. Lands must not be located within any unmasked area of a screen.

8. All lines within the terminating tab protective coating area must be parallel with the terminating tabs - no circuit line changes in direction are allowed within this unmasked area.

9. All signal via holes are to be located near the contact tabs. Generally only signals from the contact terminating tabs on the back of the card need be brought through via holes.

10. All internal plane ground pick up holes are generally located near the wire terminating tabs except where grounds enter the internal plane from contact tabs. (See electrical parameters.)

11. Incorporate use, where possible, of existing internal planes and/or hole patterns.

12. Components are not mountable on standard cable cards.

Electrical Parameters -

1. All ground inputs must enter the internal plane in the shortest possible route. i.e. the land should be located along Y grid 21 over the contact tab containing the ground input.

2. All slow and high speed cable cards must have internal planes.

3. Wherever possible a ground line or land must be placed between signal lines.

4. All circuit lines must change direction as smooth curves and not sharp corners.

5. Voltages, other than ground, are not allowed to enter the wire terminating tab area.

6. Except in special cases, voltages should not be brought out on the face of a cable card.

7. All ground via holes and terminating tabs should be connected together in the form of a ground buss or plane on the back of the card.

Layout Technique -

User cable assembly requirements will usually dictate the signal transfer requirements of a cable card. Coupled with these requirements are board design rules to consider (e.g. signal,

ground, and voltage position locations for positions requested by user - see Figures 2 through 6 for standard board voltage assignments) Once these limits are established, cable card design can proceed quickly. Suggested steps for completion of standard cable card design and layout are:

On the layout grid sheet fill out the requirements for all front and back contact tab locations in the tab squares. All "D" and "B" positions should be labeled with one of the following designations: a) open, b) signal, c) voltage (which one), or d) ground.

The wire terminating tab locations should then be filled in with the signal designations which must be transferred through the cable. These should be filled out lightly so that where these locations are not strictly dictated for electrical reasons, they can be altered by the designer to suit layout ease. Note, however, that where a previously released cable card is to be used as a terminator on the other end of a cable, the terminating tab designations will be fixed on the card to be designed.

Locate, on the layout, any requirements from the previously listed physical and electrical parameters.

Keeping in mind all other layout parameters, and samples of cable cards previously designed, connect all wire terminating tabs to their respective spring contact tabs. For layout care it is suggested that the designer start from either end and work to the opposite side as opposed to starting at the center or some other location.

Upon completion of layout and prior to sending for artwork, the layout should be checked by the cable groups in Department 154 (Electrical) and 455 (Mechanical). After approval of cable card layout design it is ready to go for artwork construction.

At this time it is suggested that the designer obtain the needed part numbers - 1 assembly no., 2 card artwork no's, 1 reference drawing, 1 laminate no., and 1 internal plane artwork number.

<u>Artworks - Card -</u>

After layout, a plug-up form is then constructed for use by the photo-lab in making up the four times size base artwork. This plug form is a grid print showing land locations in red "X's" and tab locations in red bars (extreme end terminating tabs need only be shown - see engineering specification 890911 for tab size and location.) Land diameters and tab widths are then called out as "Plug using .260 dia. lands and .180 wide cable tabs." If, during the layout two functional via holes were not placed at 23-23 and 78,23 they must be included as land plug points.

STANDARD CARD (CONTINUED)

After artwork is returned from the photo lab, a note should be placed off to the side of the card outline stating, "Opaque two lands at 23-23 and 78,23 after punching film and before step - and - repeating on glass." After the base artwork is returned, it can be taped using signal and voltage tape sizes currently dictated by "Logic Card Ground Rules" - manual artworks." The artwork part numbers are then placed in the part number block. Within the card outline area of the front artwork only, is placed "YBF" followed by the last five digits of the cable card assembly number assigned. The part number is inked in using #3 Leroy pen with a #200 template - where space is a factor a #175 template may be used. There is to be no part number within the card outline of the back artwork. Off to the right and above the unused set of contact tabs is placed the number "YBB" followed by the same five digits as used on the front artwork.

When sending half-width artworks for plugging, they are laid out as follows:

Slow Speed - a front and front is plugged on one artwork using the first and last five tabs of one socket position. i.e. two symmetrical patterns per socket positions. The back is then plugged as back - back. The center two tabs are not used for slow speed half widths.

Hi-speed - only one sheet of artwork is required as this is plugged as either a back - front combination or front - back combination depending on whether a "Top" or "Bottom" position has been designed. See Figures 5 and 6.

The above half-width artworks are drawn as such in order to yield two cards per six-pac socket position.

The artworks are now ready to be sent to the photo-lab for production glass. At this time the designer should also request a unit size positive of the artwork for use in his raw assembly drawing.

Artwork - Internal Plane -

Internal plane plug-ups are sent to the photo-lab in the same manner as for face artworks. Red "X's" are used to locate the position where there is to be a clearance hole (ring land) located. The note on the plug-up form should read, "Plug using standard internal plane ring lands." This artwork also requires two solid lands at 23-23 and 78-23 providing these positions do not already locate ring lands. If solid lands are used the finished artwork must have the note as previously stated for card artworks, "Opaque solid lands at 23-23 etc."

STANDARD CARD (CONTINUED)

It is possible that, as a result of a tight layout, two ring lands will interfere with one another. If this condition arises, the plug-up should contain only those which can be plugged. After the base artwork is returned from the photo-lab, ring lands which have been cut out of another spare artwork will then be hand taped into the locations which were not pluggable. Ring land edges may therefore interfere, or lie one upon another. The internal plane border is then placed along the perimeter of the card using .160 (4x) tape so that .080 (4x) lies either side of the card outline. The internal plane artwork number is then placed in the title block and also inked, using #3 Leroy pen with #140 template, near the top edge and within the card outline. The number should be inked so that one blank character space separates each digit.

This artwork is now ready to be sent to the photo-lab for production glass processing.

Screen Artworks -

In addition to the electrical value provided by card coating, the lack of it on a portion of a card allows us to solder dip it and thereby cause solder to adhere to the uncoated surface. This solder is then used in a further assembly operation such as cable wires to card or resistors to card.

Screen artworks for standard cable cards must have an uncoated wire terminating tab area. Screens for R/Pacs, in addition to uncoated wire terminating tabs, have uncoated resistor - R/Pac mounting holes. Basic screen outline requirements are contained in Engineering Specification 890911.

Part numbers for screen artworks are not of the released part number series. Screen artwork part number assignment is as follows:

Common screen artwork - an artwork which is common to two or more card assemblies can have a special number assigned by Mr. Tom Homa, Dept. 729. The numbers for the standard sizes, shown in Figure 1, are of this type: e.g. 0014, 0015, 0016, and 0017.

Specific screen artwork - an artwork which is unique to a specific card. The part number for this type will be the last five digits of the card assembly number (standard size card) or last five digits of base raw card number (R/Pac card).

STANDARD CARD (CONTINUED)

Artworks which are symmetrical for front and back use only one number such as 0014. For non-symmetrical screens which require two artworks per card the base number is the same, however, the front artwork number is preceeded by a 0 dash and the back by a 1 dash, e.g. 0-0014 front; 1-0014 back.

Solid land requirements at 23-23 and 78,23 for artworks apply here.

Documents -

Documents, necessary to complete a cable card release package consist of the following:

Assembly - Two special blocks exist for a cable card assembly number. These blocks are either 58006XX or 5805XXX. Standard drawing forms exist for cable card sizes shown in Figure 1. The unit size film of the artworks is taped into position and the drawing is sent for master duplication to Department 385. After the master is returned the following information should be printed on it: Part numbers - assembly, front and back artwork, engineering specification, hole pattern, internal plane laminate, contact, housing, and screen numbers. It should also contain the contacts used, wire terminating tab designations, and other information necessary. This document must ultimately show a "tech status" and REL signature approval.

Hole Pattern - The hole pattern part number is of the 81XXXX series. Master forms for this document are available. This document contains the holes which must be drilled into the card. These holes are located using the standard grid numbering system for hole patterns. As a cross check of documents these hole locations should correspond with the locations of holes on the layout and artworks. The hole quantities and etching/plating conditions as well as appropriate engineering specification references are then noted on the drawing.

Split-pac card hole locations are drawn so as to fill a full six pac socket position - the same method that was used to construct artworks is effectively duplicated here. Grid numbers for hole locations are then listed as if the card were a six-pac. A note indicating that the second card location is shown for manufacturing purposes only, is then added. This drawing is a "reference drawing" and does not require approval beyond Endicott manufacturing.

STANDARD CARD (CONTINUED)

Laminate Drawing - Part numbers for this drawing are of the 81XXXX series. On this drawing is located a 4x positive of the internal plane artwork. Grid locations are used to locate all ring lands. Internal plane artwork numbers, engineering spec. numbers, and appropriate notes complete this drawing.

In the case of split-pacs, a side by side picture is drawn similar to the hole pattern for split-pacs above.

This drawing is an assembly drawing and requires Material Lab and REL sign off.

CROSSOVER CABLE CARD

Hi-speed family - uses same parameters, layout technique, and document procedures as outlined for "STANDARD CABLE CARDS."

Low-speed family - uses same procedures as outlined for the hi-speed family above except that the .042 signal wire centers "tab configuration" is used. Note also that in Figure 2 (A or N column) B02 is an open position.

R-PAC CABLE CARD

An R/Pac cable card is a class of cable cards (See figure 1) on which resistors or R/Pacs are mounted. These resistors are generally used to terminate cable lines. Layout of R/Pac cable cards is similar to that used in designing Standard Logic Cards except that the wire terminating tab area conforms to that of Standard Cable Cards.

The user must submit his request to Endicott Circuit Technology for approval and issuance of proper circuit flyers and/or ALD's as needed. This approval is required before card design can begin.

Parameters -

Physical - Same as for Standard Cable Cards except:

Item 7(a) - Same as logic card ground rules
(b) - Same as logic card ground rules
9 - Does not apply
10 - Unless specified, internal planes are not used.
12 - Components are mountable on front side only.

R-PAC CABLE CARD (CONTINUED)

Electrical - Same as for Standard Cable Cards except:

Item 1 - Same as logic card ground rules
2 - Does not apply
3 - Does not apply
4 - Same as logic card ground rules
6 - Applies as required
7 - Applies near top of card only - near wire terminating tabs.

Other -

In addition to the above, certain restrictions for manufacturing purposes apply. Since this type of cable card travels through the standard assembly line as a 2-Hi 12 pac card until the final "cut to 2.150 high operation," it must conform to the same requirements as logic cards, e.g. no component brick-walling, .040 edge mounting restrictions, etc.

For R/Pac cable cards which mount in any row other than the "N" row, Logic Card ground rules apply with the exception that, when designing the card, components or their bodies may not go over a restricted line 1.588 inches from the bottom of the card. This restriction is required to allow room for cable soldering tools.

Figure 7 shows packaging and cable assembly restrictions for component locations which must be considered during R/Pac cable card design for cards which mount in the "N" row. Explanatory restriction notes are provided on the Figure.

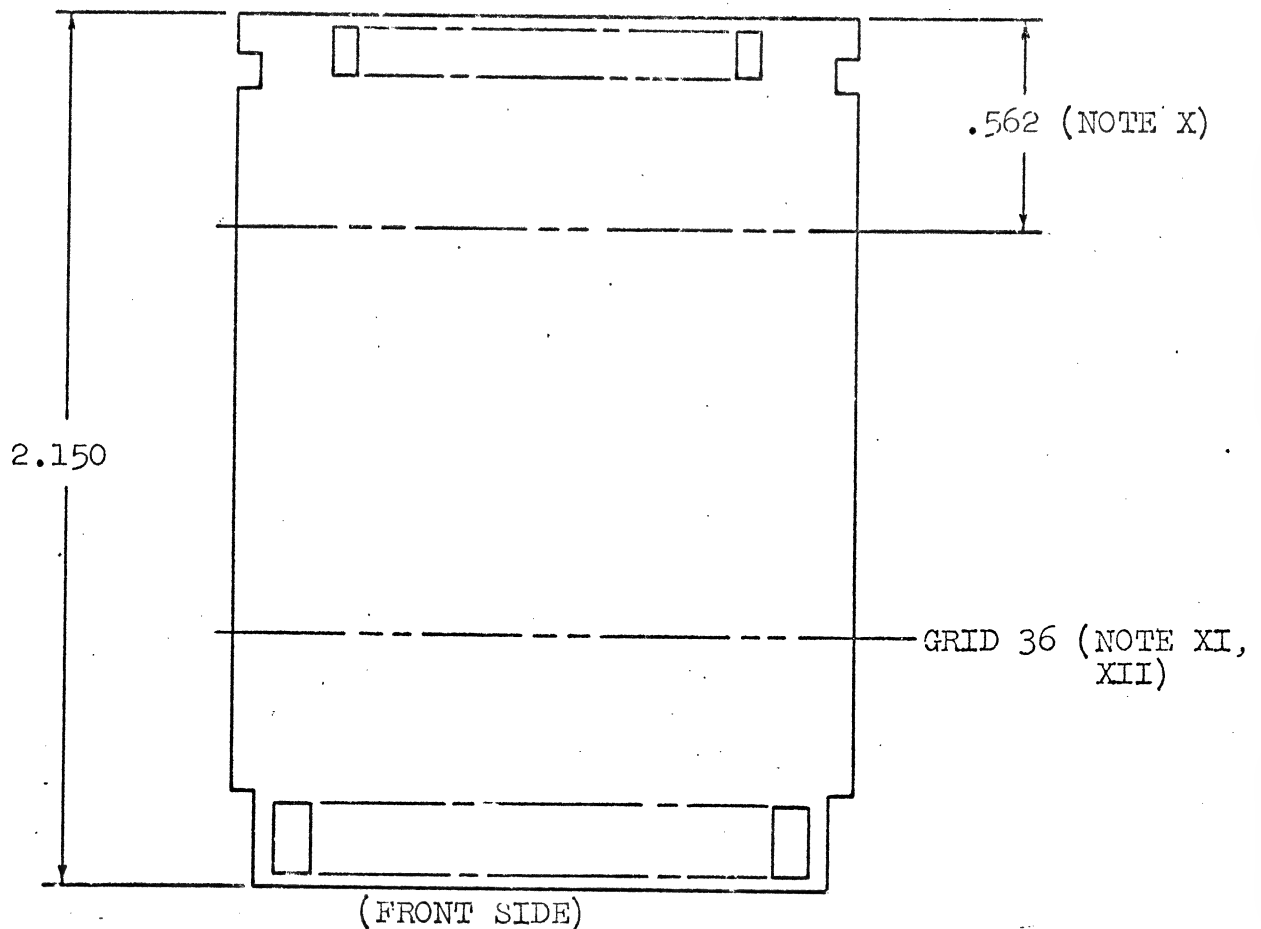
Layout Technique -

Layout technique and design will follow that set down for Standard Logic Cards, with the layout of the wire terminating tabs followed that for standard cable cards.

Artwork - Card -

Artwork procurement and taping will also follow the rules set down for standard cable cards except for part number assignment and identification. R/Pac raw card, front, and back artwork numbers are the same (581XXX), however, as in standard cable cards

R-PAC CABLE CARD (CONTINUED)

FIGURE 7

'R-PAC' RESTRICTIONS ('N'-ROW APPLICATIONS)

NOTE X Due to Kingston Mfg. cable clearance requirements, no components or portions of components may lie within this area.

NOTE XI Components, mounted in accordance with Logic Card Ground Rules, may lie above Grid 36.

NOTE XII Below Grid 36 component height above card surface must not exceed .290.

R-PAC CABLE CARD (CONTINUED)

the last five digits of the card assembly number, preceeded by YBF, will appear within the card outline area of the front artwork. The complete raw card number, preceeded by YBB, will appear within the card outline area of the back artwork. In addition to the raw card number appearing on the back side, it is necessary to include the note "File with YBF" (last five digits of the related assembly number). This note should appear to the right of the card outline and above the set of unused tabs.

Documents -

Assembly - R/Pac assembly numbers are contained within a block 5805XXX. A minimum of three sheets is required for the assembly drawing. Sheet 1 is the "ALD" - block diagram of electrical layout, Sheet 2 is a manually drawn assembly drawing showing R/Pac - resistor mounting locations etc. Sheet 3 and above normally contain the schematic of the assembly - electrical representation of Sheet 1.

Hole Pattern - Requirements are similar to the standard cable card hole pattern.

Special Cable Cards

These Ground rules cannot contain the requirements for special cable cards therefore, they must be handled on an individual part number basis. Special cable cards must conform to the sizes shown in Figure 1. Prior to the release of any special cable card, Kingston cable manufacturing must be informed of its pending release - they should be furnished with documents as soon as possible.

Special cable cards require Purchasing Engineering Endicott, and Kingston Manufacturing sign off. Department 455, which has liaison contacts with Kingston, can assist in obtaining approval for special cards.

SCOPE

This section includes a definition of special cards and the requirements for obtaining manufacturing build for these Special Cards.

TABLE OF CONTENTS

DEFINITION

Any card which does not meet the SLT Card Layout Ground Rules. In general, special cards are those which cannot be released via EDT and require manual release. Most common ground rule deviations include off-grid (non-.025) drilling, non-standard drill size, non-standard card size and notching or special milling.

Maximum size of special cards are limited to the basic manufacturing panel size which is 10" x 15" including scrap. Maximum usable area is approximately 9" x 14". Thickness is .040 ± .004.

RELEASE PROCEDURE

All special cards are released through Department 312-Endicott. Prior to actual release manufacturing pre-analysis and sign-off must occur.

Information Required -

The following information is required for pre-analysis:

Justification -

Justification for a special card. This can be either technical or economic.

Drawings -

A complete set of reproducible drawings describing the finished card including size, hole location and circuitry, both internal and external.

Quantities -

Production quantities including first production parts, 5 year production broken down by quarter first 2 years and by year remaining 3 years.

Manufacturing Pre-Analysis -

Manufacturing pre-analysis is necessary to determine capability for manufacture of the special card and if special tooling is required.

RELEASE PACKAGE

The release package will include complete master drawings describing the special card and a net list. The net list is in lieu of an EDT and will be used by manufacturing to develop numeric control information including test tapes and drill tapes. Information describing the net list will be distributed by Department 312 to all card layout groups so net lists can be included in all future manual release packages.

ARTWORK

Artwork for manual releases will be generated by manufacturing from information included in the release package. Therefore complete information must be available on the "raw card" drawing to describe finished line widths and spacing, land sizes and location, specific line routing if required and any special area which is to be free of protective coating.

The artwork scribing equipment is basically capable of scribing on glass in a x or y direction with limited capacity for angular lines (i.e. 45° or other angles). Standard SLT circuitry should be specified wherever possible.

SCOPE

This suffix defines the documentation and procedures required to process SLT cards through Dept. 147, Packaging Documentation Engineering.

TABLE OF CONTENTS

Figure 1. FLOWCHART

IBM Division Engineering Practice

SLT CARD DOCUMENTATION & PROCEDURES

DOCUMENT DESCRIPTION

The following chart lists those documents required for Dept. 147 processing.

DOCUMENTS REQUIRED CHART

DOCUMENT	FIG.	FORM NO.
Automated Logic Diagram ALD	1	*
Circuit Schematic	2	82-011
Assembly Drawing	3	*
Raw Card Drawing	4	*
Bill of Material Card Assembly	5	*
Bill of Material Raw Card	6	*
EC Work Sheet	7 & 8	**
CD Engineering Work Request	9	624-9122-0

* Computer Print Out

** With Form No. 620-8219-3 - EC Work Sheet must be used. Form numbers indicated can be ordered through stationery store.

CARD ALD

The Automated Logic Diagram tape is sent directly to Dept. 739 by Teleprocess job number 98-123, station 34. At the same time the LMTX tape is sent to Dept. 310, Glendale, to produce the LTD card decks required for testing.

CARD CIRCUIT SCHEMATIC

Card Circuit Schematics are sent to Dept. 147 Control Desk where they are made part of the Manual Documents. If the schematic is a:

1. Release - A new pencil cloth master is required, made out entirely in ink or pencil conforming to Corporate Drafting Standards and will be retained in the master tracing file.

2. Change - A current level brownline is required and must show all new changes marked in red.

Electrical Representation

The schematic will show a complete electrical representation of the card with cross reference to the physical location pins, components, and component elements on the card assembly. A component element refers to devices having more than one electrical component. These element locations are specified by numbering each of the component leads on the schematic. All bussing notes must appear on first sheet of schematic.

Card Circuit To Circuit Flyer Cross Reference

The card schematic must show the circuit flyer block I.D. numbers of the circuit flyers used on the card. These block I.D. numbers should be placed so that it is readily apparent which portion of the card schematic represents the circuit flyer used. Ref: Suffix 3, Section 23A

COMBINED ALD SCHEMATIC

The ALD-SCHEMATIC is a single computer-generated document that satisfies both ALD and Schematic requirements. When it is used, an individual schematic document is not required; however, it may only be used if the circuit elements associated with each circuit flyer used on the card are contained within one component. An advantage to this method is that the ALD-SCHEMATIC is kept on a Logic Master Tape (LMT); this provides the user with a history on one tape. Also realized when using this method is a reduction in the number of card documents required to support the physical card assembly. Ref: Suffix 3, Section 23B

EDT

Definition

The Engineering Description Tape (EDT) is generated by the Circuit Card Design Automation (CCDA) Program. This program is designed to transfer an engineering description of the SLT/SLD card onto magnetic tape. The format of the EDT, so produced, is processed in the Document Control Center.

Machine Generated Release Documents

The outputs printed out by Document Control Center from the EDT and used by Dept. 147 consist of the following:

ALD Drawing

Assembly Drawing

Raw Card Drawing

B/M of Card Assembly

B/M of Raw Card

Hole Pattern Drawing (Not released with the Card Package)

COMPONENT EARLY WARNING SYSTEM (CEWS) Reference CEH 0-2568-001

Use

The component early warning system enables manufacturing and engineering to assess the impact of an engineering release or change involving small cards and their components, in advance of the formal release by providing an early evaluation of the component requirements needed to support the release or change.

Information Required

Form number 1 (Release) must include all components, hardware and raw card.

Form number 2 (Change) must include all components and hardware added or deleted as well as raw card level change.

These forms are sent to Dept. 519 for processing. Upon their approval, a form number 5 will be sent to Dept. 147 which will allow release of the package.

Further information can be obtained from CEWS Procedure found in IBM Standards CEH 0-2568-001 or contact Dept. 519, CD Production Control, Endicott.

CD ENGINEERING WORK REQUEST

The work request is used to control the card during processing, both at the controlling lab and through Dept. 147. The information required at the controlling lab will vary depending on local internal requirements. Forms available from Dept 147 Endicott, N.Y.

Information Required

The minimum information required for card release or change activity by Dept. 147 is listed below and identified by circled numbers on CD ENGINEERING WORK REQUEST, Figure 9.

1 Raw Card Part Number -

A 7-digit raw card part number. Card numbers are controlled by Dept. 147 and assigned to controlling labs upon request.

2 Internal Plane -

A 6-digit internal plane part number. If there are no internal planes, insert 19-701.

3 Engineering Change Number -

The formal release number and alpha code under which card documents are to be released or changed. EC numbers are controlled by Dept. 147 and assigned to controlling labs upon request.

4 Assembly Number -

Assembly numbers are controlled by Dept. 147 and assigned to controlling labs upon request.

5 Circuit Investigated and Approved -

Must be signed and dated by the manager or a delegated representative of the manager.

6 Package Investigated and Approved -

Must be signed and dated by the manager or a delegated representative of the manager.

7 Package Cycle -

Must be filled in to show Packaging cycle time.

8 Change Activity Code -

Indicate code 0, 1, 2, etc. Reference: Product Documentation Procedure #6.1.00.

9 Account Number -

All charges for processing will be applied to this number which may be on IPT or Purchase Order.

10 Location Pre Analysis -

Manufacturing and Testing Pre Analysis representatives must sign and date after approving Card Assembly. Final approval will be given by Endicott Pre Analysis representatives.

11 IPT/Purchase Order -

Insert IPT or Purchase Order number.

12 Location To -

Packaging Group

13 Location From and Date -

The department responsible for the documents must be shown including person, location, department, and division.

14 Project Name -

Required only if the machine type number has not been assigned.

15 Division Chargeable for Scrap and Rework -

Check appropriate Division (SDD or CD).
Control desk will audit and will not process if neither Division is checked.

16 Product Code -

If CD was checked in space number 15, a product code should be entered here.

17 Machine Type -

If SDD was checked in space number 15, a machine type number should be entered here.

18 System -

Must be shown if available.

19 Technology -

State whether ASLT, SLT, MST, etc.

20 Circuit Family -

The circuit family must be shown 5 ns, 30 ns, etc.

21 Circuit Name -

The circuit name should be shown, for example: "4 way AOI".

22 Card Size -

Show size, SLT - 1-06, 1-12, 2-24 (ALD term), etc.

23 Date Required - Model Cards - Production -

Show date in appropriate block.

24 Reason for Change -

Reason why card is being changed. Every request should contain comments regarding any restriction such as "held items" or similar manufacturing restrictions. If in number 15, SDD scraped or initiated rework and checked CD to be charged, an explanation should be noted here indicating name of person approving charge.

25 Circuit Flyer Changes Required and EC -

Self-explanatory.

26 Disposition -

Must be indicated for both Raw Card and Card Assembly on all changes.

Use codes as defined in CES 0-2022-0 stock disposition codes.

27 Stock Status and Date -

Self-explanatory.

28 User Approval -

When a change is to be processed all users must be notified and their approval obtained.

29 Replaces -

When a card being released replaces another, the replaced card should be identified along with its intended disposition.

30 Similar To -

If a card is similar to an existing card, the existing card part number should be given.

31 Performance Level -

Must be stated on every work request or job will be returned to originator.

32 Request Approved By -

Signature of manager approving request.

ENGINEERING CHANGE WORK SHEETS

When Required

Each document in a work package requires an Engineering Change Work Sheet (IBM Form 620-8219-3).

Description

The description of a change should only reflect the changes that have occurred between the current release documents and the new change activity. This perhaps can only be accomplished by having the person writing the change description make a comparison check of both the old and the new documents.

Engineering Notice Titles and Activity Codes (Cover Page)

Each engineering change must include one of the titles defined in Endicott SDD's Product Documentation Procedure Number 6.1.00. The most common are:

Activity Code: 0 - Release
1 - Design Refinement
2 - Factory Service
3 - Cost Reduction

Obsolescence and Field Use are sub-titles under Design Refinement.

Performance Level (Cover Sheet)

Performance levels must be given, indicating the current functional level of the card. Changes that effect the electrical parameters of the card raise the performance level.

General Reason (2nd Page of Work Sheet)

Changes may be covered by the following general reasons when applicable:

1. Changed component coding, numbering, or location.
2. Altered transistor symbols, drawing format, notes, (whichever applies) to agree with current procedures.
3. Because of logic sheet modification.
4. Because of artwork correction.
5. Because of a layout error.
6. To agree with circuit flyer change.
7. To agree with current ground rules.
8. Card completely redesigned.

It should be noted the above reasons are typical reasons only. Each job is to be treated on its own merits.

Drawing Size

Drawing size will be given as A, B, C or G. Multiple sheet drawings should indicate drawing size and number of each. Examples: 3C, 2G, etc.

Explanation of Affected Documents

A brief description should be given explaining the changes on each page of ALD, Schematic, Assembly Drawing or Raw Card.

Example 1: ALD Sheet 1 - Not affected, but being processed to maintain all sheets at the same level.

ASM Sheet 2 - Removed Module 25AB part number 361123 to agree with new circuit flyer information.

Schematic Sheet 3 - Remove circuitry associated with Module 25AB part number 361123 to agree with Sheet 2.

Raw Card Sheet 1 and 2 - Raised raw card level from "0" to "1" due to circuitry change.

Example 2: ALD Sheet 1 - Change status from Experimental Restricted to Experimental Active to agree with circuit flyer.

ASM Sheet 2 - Change note reference from FA and HA to FM to agree with current ground rules.

Schematic Sheet 3 - Not affected, but being processed to maintain all sheets at same level.

Raw Card Sheet 1 and 2 - Not affected. Raw Card level remains at "0".

NOTE: Change Notices in this form are of significant value to the Factory for analysis of changes.

Dispositions

Disposition Codes must be applied to parts affected by an engineering change. The code normally applies to parts in stock, or in process.

Examples: Disposition 1 - Immediately scrap all parts in stock, or in process.

Disposition 11 - Use "as is" all parts in stock, or in process.

For further information, see CES 0-2022-00.

Rework

When it is necessary to rework card, Dept. 307, Factory Service Records Control should be provided with the necessary information so that rework documents may be prepared using Rework Instruction Form Number 624-9181-0.

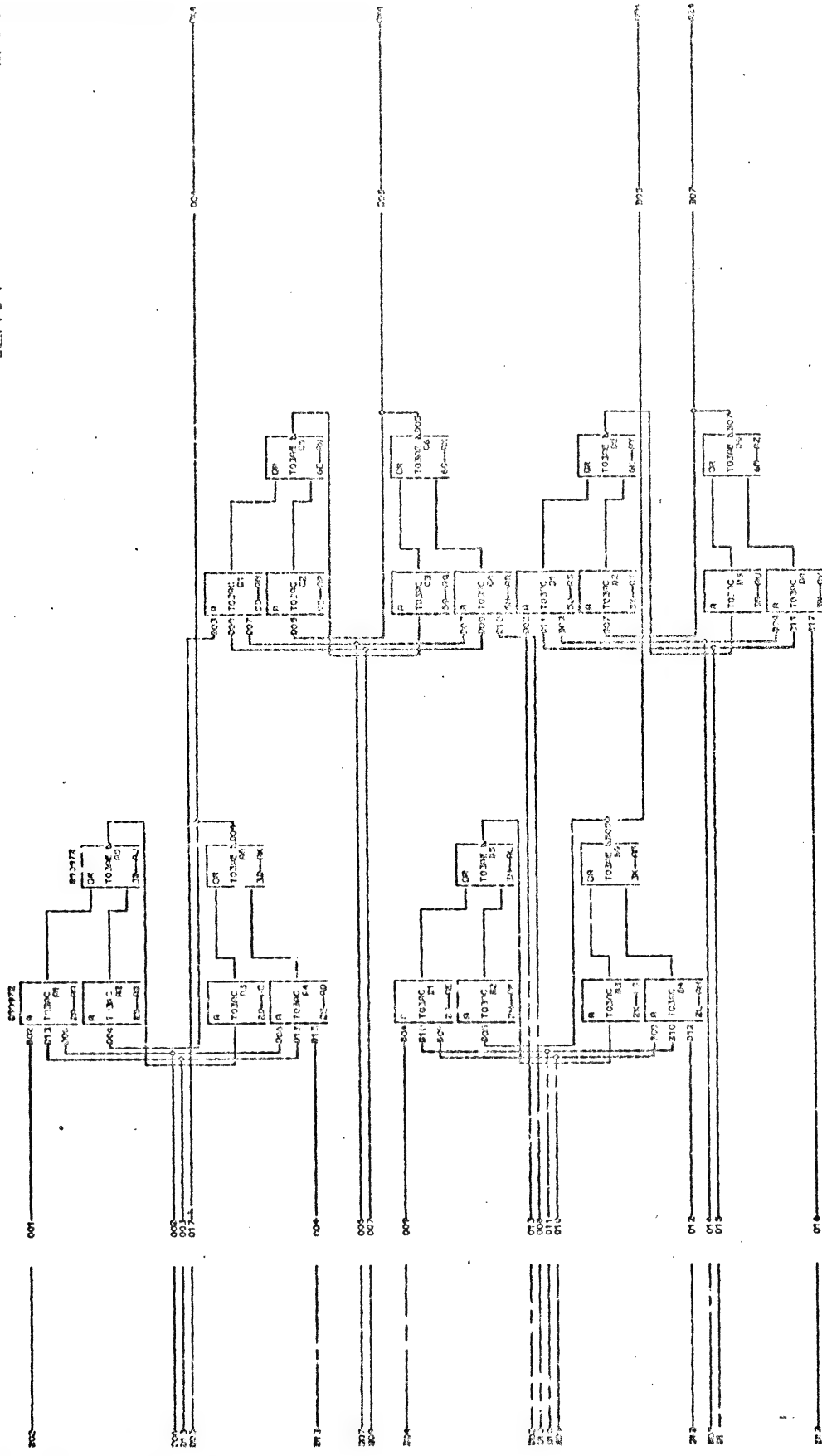



Figure 1 AUTOMATED LOGIC DIAGRAM (ALD)

5803402
SHEET 4 OF 4

INTERNATIONAL BUSINESS MACHINES CORP
CARD ASM - FOUR SUBSET ADAPTER

STANDARDS CODE — CARD CODE 3402

NOTE: Bussing Note

Figure 2 CIRCUIT SCHEMATIC

STANDARDS CODE	3-7045		SHEET 2 OF 4	5803402
CIRCUIT APPROVAL	JES	01-05-65	STATUS	ACTIVE
LOCATION	KINGSTON			RESTRICTED
RAW CARD NUMBER	5816013 2		HOLE PATTERN	5816013
FRONT ARTWORK	DATE	CHANGE NO.	DATE	CHANGE NO
5816013	01-18-65	162203 A		
BACK ARTWORK	08-04-65	164704 B		
5816013				

PIN	VOLT.
D 8	GND
B 3	+ 3
D11	+ 6
B 6	- 3

CODE	PART NO	VALUE	QTY
Z 1	361453	SLT MODULE	8
Z 2	361456	SLT MODULE	4
A 1	2414883	RC MODULE	3

NOTES.
AA-ALL CIRCUITS MUST CONFORM TO ENG.SPEC. SHOWN ON SHEET 1.
AB-ASSEMBLE TO ENGINEERING SPECIFCATION #90913
AC-CARD CONFORMS TO DECOUPLING REQUIREMENTS IN 811800.

CONTACTS ON BACK OF CARD

INTERNATIONAL BUSINESS MACHINES CORP.					
NAME	CARD AS-FOUR SUBSET ADAPTERS				
DESIGN	12-17-64	NIS	TYPE	2702	
DETAIL	12-17-64	NIS	SCALE	NONE	
CHECK	12-30-64	JJ	DRAW	7090	10-13-65
APPRO	01-05-65	JES	L.C.N.		LAMINATED

5803402

Figure 3 ASSEMBLY DRAWING

Figure 4 RAW CARD DRAWING

IBM ENGINEERING BILL OF MATERIAL B/M NUMBER 5804998

DATE 01 23 67 SHEET NO. 01

TITLE
01 CARD A 3 HI 12 K7Q
02 CARD ASM A GROUP AND C

CHANGE LEVEL		FILE	STATUS	REQUESTOR
LATEST	169267 B			
PREVIOUS		E	ACTIVE	EXPRESS DEPT. ENG END

DWG SIZE A B C D E F AUT

BASIC NAME	DESCRIPTION	PL	CH	R	PART NO	UM	QTY	REFERENCE	SECT	MPL	FILE
ENG SPEC		R	R		873249					R	E
ENG SPEC		R	R		873476					R	E
ENG SPEC		R	R		890913					R	E
RESISTOR	RES 1600		D		216450	01	4				E
RESISTOR	RES 47.000K		D		216484	01	4				E
RESISTOR	RES 470		D		317011	01	4				E
CAPACITOR	CAP 150.000PF		D		350432	01	4				E
SLT MODULE	SLT MODULE F		D		361459	01	4				E
TRANSISTOR	TSTR 084 TYPE		D		369390	01	4				E
SPACER-	TSTSTR STANDOFF T		D		811157	01	4			L	E
SPACER-	TSTSTR STANDOFF T		D		811399	01	8			L	E
RESISTOR	RES 55.100K		D		813221	01	4				E
RESISTOR	RES 1.300K		D		813225	01	4				E
R/C MODULE	RC MODULE .12		D		2414883	01	4				E
DIODE	DIODE 5		D		2414885	01	4				E
TRANSISTOR	TSTR 138 TYPE		D		2414918	01	4				E
R/C MODULE	RC PACKAGE .12		D		2414961	01	8				E
RAW CARD			A	3	5819138		1				E

Figure 5 BILL OF MATERIAL CARD ASSEMBLY

IBM ENGINEERING BILL OF MATERIAL B/M NUMBER 5818844

DATE 01 06 67 SHEET NO. 01

TITLE
01 RAW CARD 3 HI 12 L7Z
02 M2 SA & INHIBIT

CHANGE LEVEL		FILE	STATUS	REQUESTOR
LATEST	166541 E	E	ACTIVE	EXPRESS DEPT. ENG END
PREVIOUS				

DWG SIZE A B C D E F AUT
1 (under C)

BASIC NAME DESCRIPTION	PL	CH	R	PART NO	UM	QTY	REFFRENCE SECT	MPL	FILE
ENG SPEC	R	R		890911				R	E
INT PLANE		C		811231	01	1			E
CONTACT SPCONTACT		D		811300	01	48		L	E
HOUSING 1212 MOD CONNECTO		D		811305	01	1		L	E

PL	PLANING CODE
	REGULAR USAGE
J	AS REQUIRED
M	REMOVE ITEM
P	BULK MATERIAL
R	REFERENCE MATERIAL
I	SUBSTITUTE PART
N	SEMI-AUTOMATIC
K	DOCUMENT CROSS REFERENCE

CH	CHARACTER CODE
A	MANDATORY ASSEMBLY
C	REFERENCE ASSEMBLY
D	WITHOUT B/M
J	GROUP B/M
R	FACTORY REFERENCE
S	REFERENCE MATERIAL TO BE SHIPPED

R	REASON CODE
1	FUNCTIONAL SIGN
2	FIELD REPLACEMENT
3	CORP. STANDARD

U/M	UNIT OF MEASURE CODE
01	PIECE EACH

Figure 6 BILL OF MATERIAL RAW CARD

IBM ENGINEERING NOTICE

EC NUMBER 169267 | SHEET 2 OF 3

REC CODE	STATUS	PART NUMBER	SEQ.	DWG SIZE	NC SHEET	CHAR. CODE	DOCS AFCT	DOC AVL	LANG.	DSPN.	PURPOSE	COMMENTS FOR PARTS AFFECTED
6		5804998	01	C	2	A	3			6		Card Asm: 2-36
"		"	02	C	3							Plant of Control changed from Kingston to
"		"	03									Poughkeepsie.
"		"	04									Reason: Sheet 1 - Control Code changed from
"		"	05									KM to PM.
"		"	06									Sheets 2 & 3 - Changed P/N 369696
"		"	07									transistors 3Q1, 4Q1, 6Q1 and 7Q1 to
"		"	08									transistor P/N 369390 to agree with
"		"	09									Flyer. Card level raised from "2" to
"		"	10									"3. due to hole size updating per la-
"		"	11									test Ground Rule Procedure.
"		"	12									Sheets 4 & 5 - Not Affected.
"		"	13									Explanation: Rework all parts as/per Advance
"		"	14									Marked Prints 5804998/5819138 issued on Advance
"		"	15									E/C 169267 filed in Dept. 601 dated 13JAN67.

RECORD CODES
1-CHANGE OF CONTROL
2-ISSUE
3-TERMINATE
4-RELEASE
5-CHANGE OF STATUS
6-REVISED
7-RECORDS CHANGE ONLY

CHARACTER CODE
A-MANDATORY ASM.
C-REFERENCE ASM
D-DETAIL
J-GROUP BM
R-REFERENCE MATERIAL

STATUS CODES
REC. CODES "2" AND "4"
A-ACTIVE
J-FIELD USE
O-OBSOLETE
S-STANDARD

REC. CODE "5"
CHANGE FROM
1-STANDARD TO ACTIVE
2-OBSOLETE TO ACTIVE
3-FIELD USE TO ACTIVE
4-OBSOLETE TO FIELD USE
5-ACTIVE TO FIELD USE
6-ACTIVE TO OBSOLETE
7-FIELD USE TO OBSOLETE
8-OTHER (SPECIFY)

DOCUMENTS AFFECTED
1-BILL OF MATERIAL
2-DRAWINGS
WIRING DIAGRAMS
AUTOMATED LOGIC
ARTWORK (FILL IN DRAWING SIZE FIELD FOR NEAREST LARGER DRAWING SIZE)
3-1 AND 2
4-INSTRUCTIONS LISTS
5-1 AND 4
6-2 AND 4
7-1, 2, AND 4
8-SPECIFICATIONS
9-TEST DECKS

DOCUMENT AVAILABILITY
F-FORWARDED LATER
N-NO DOCUMENT
BLANK-INCLUDED WITH NOTICE

DRAWING SIZE
A THRU F-NORMAL USE FOR DRAWINGS
G-AUTOMATED DWG.

LANGUAGE OF DOCUMENT
E=ENGLISH
F=FRENCH
G=GERMAN
I=ITALIAN
J=JAPANESE
P=PORTUGUESE
S=SPANISH
N=SWEDISH-NORDIC

620-8219-

Figure 7 EC WORK SHEET

IBM ENGINEERING NOTICE

EC NUMBER 169267 — SHEET 3 OF 3

REC CODE	STATUS	PART NUMBER	SEQ.	DWG SIZE	NO SHEET	CHAR CODE	DOCS AFCT	DOC AVL	LANG.	DSPN.	PURPOSE
6		5819138	01	G	2	A	3			12	
"		"	02								
"		"	03								
"		"	04								
"		"	05								
"		"	06								
"		"	07								
"		"	08								
"		"	09								
"		"	10								
"		"	11								

COMMENTS FOR PARTS AFFECTED

Raw Card Asm: 2-36

Reason: Raw Card Level raised from "2" to "3" due to hole size updating per latest Ground Rule Procedure.

Explanation: Balance out cards to deplete stock on Assembly 5804998 using Advance Marked Prints 5804998/5819138 filed in Dept. 601 dated 13JAN67.

RECORD CODES
1 - CHANGE OF CONTROL
2 - ISSUE
3 - TERMINATE
4 - RELEASE
5 - CHANGE OF STATUS
6 - REVISED
7 - RECORDS CHANGE ONLY

CHARACTER CODE
A - MANDATORY ASM.
C - REFERENCE ASM
D - DETAIL
J - GROUP BM
R - REFERENCE MATERIAL

STATUS CODES REC. CODES "2" AND "4"
A - ACTIVE
J - FIELD USE
O - OBSOLETE
S - STANDARD

REC. CODE "5" CHANGE FROM
1 - STANDARD TO ACTIVE
2 - OBSOLETE TO ACTIVE
3 - FIELD USE TO ACTIVE
4 - OBSOLETE TO FIELD USE
5 - ACTIVE TO FIELD USE
6 - ACTIVE TO OBSOLETE
7 - FIELD USE TO OBSOLETE
8 - OTHER (SPECIFY)

DOCUMENTS AFFECTED
1 - BILL OF MATERIAL
2 - DRAWINGS
WIRING DIAGRAMS
AUTOMATED LOGIC
ARTWORK (FILL IN DRAWING SIZE FIELD FOR NEAREST LARGER DRAWING SIZE)
3 - 1 AND 2
4 - INSTRUCTIONS LISTS
5 - 1 AND 4
6 - 2 AND 4
7 - 1, 2, AND 4
8 - SPECIFICATIONS
9 - TEST DECKS

DOCUMENT AVAILABILITY
F - FORWARDED LATER
N - NO DOCUMENT
BLANK - INCLUDED WITH NOTICE

DRAWING SIZE
A THRU F - NORMAL USE FOR DRAWINGS
G - AUTOMATED DWG.

LANGUAGE OF DOCUMENT
E = ENGLISH
F = FRENCH
G = GERMAN
I = ITALIAN
J = JAPANESE
P = PORTUGUESE
S = SPANISH
N = SWEDISH - NORDIC

620-8219

Figure 8 EC WORK SHEET

CD ENGINEERING WORK REQUEST SHEET ___ OF ___

RAW CARD PART NO.	INT. PLANE NO.	ENG CHANGE NO. 16xxxx	ASSEMBLY NO 580xxxx

CIRCUIT | PACKAGING CYCLE

INVESTIGATED BY G.A. Trudgen	APPROVED BY	START DATE	DAYS ON HOLD	CHARGE ACTIVITY CODE

PACKAGE

INVESTIGATED BY	APPROVED BY	ACCOUNT NUMBER

LOCATION PRE ANALYSIS

MANUFACTURING	TEST	IPT / PURCHASE ORDER

	NAME	DEPT	PHONE	LOCATION	DIVISION	DATE
TO	P.T. Howard	308		Endicott	CD	
FROM	R.M. Healey	332	2156	Endicott		

PROJECT NAME	DIV. S&R / CHARGE	PROD. CODE	MACHINE TYPE 1442	SYSTEM
TECHNOLOGY	CIRCUIT FAMILY	CIRCUIT NAME		CARD SIZE

☐ NOT REQD	VOLT	PINS	NOTE:	VOLT	PINS	DATE REQUIRED
INT. PLANE: GD ONLY ☐						MODEL CARDS
VOLT GD ☐						
☐						PRODUCTION
☐						

DISPOSITION	ASSEMBLY	RAW CARD	STOCK STATUS & DATE	USER APPROVAL ☐ OBTAINED ☐ NOT REQUIRED
REPLACES		SIMILAR TO		PERFORMANCE LEVEL

REASON FOR CHANGE:

Transfer of Control Code

1. Lab making transfer - Endicott
2. Lab receiving transfer - Rochester
3. Individual making transfer - R.M. Healey
4. Individual receiving transfer - D.Sharp
5. Effective date of transfer - 6/10/66
6. Suspense Notice - N/A

LMT
CHT
Browline of latest level circuit flyers

CIRCUIT FLYER CHANGES REQUIRED AND EC:

DISTRIBUTION:

1. FORWARD ORIGINAL TO: CD DEPT 147 PO BOX 6 ENDICOTT N.Y. ATTENTION: ______
2. FORWARD COPIES TO: MACHINE GROUP, CIRCUIT PACKAGING, PRODUCT ENGINEERING

REQUEST APPROVED BY (MANAGER) S.J. Zwirble

ATTACHMENTS:
☐ CEWS FORM (COPY)
☐ WAIVER LETTER

FORM 084-8108-2

Figure 9 CD ENGINEERING WORK REQUEST

RELEASE AND CHANGE PROCEDURE

A. Manual Documents Required:

1. Work Request

Must be complete as indicated (See Section 1)

2. Card Circuit Schematic (See Section 1)

a. Release - Cloth master
b. Change - Brownline of previous level

3. EC Work Sheet

Required for changes only (see Section 1)

B. Automated Documents: **

1. ALD

EC level A (See Section 1)

2. EDT

EC level A (See Section 1)

Comments

* Send to Control Desk, Department 147, Bldg. 676, Endicott.

** Send tapes to Dept. 739, Bldg. 022-4, Endicott.

AREAS REQUIRING SPECIAL ATTENTION

1. A review of past history indicates that the following are the most frequent errors. Special attention must be given to these areas and a thorough final check must be made before jobs are sent to Dept. 147 for processing. This will help reduce the number of jobs being placed on HOLD and possibly requiring a recycle.

2. Artwork changed and level of raw card not raised.

3. Components mounted with insufficient clearance.

4. Circuit lines in restricted area of card.

5. Test specs. not yet released by controlling lab.

6. Test specs. not on EDT.

7. Voltage pin bussing note on circuit schematic - missing or incomplete.

8. Unused voltage pins indicated on ALD and Asm. Drawing.

9. Current EC level and previous EC history missing on some documents.

10. Material disposition not indicated on work request.

11. Sheet numbering missing or incorrect on automated documents.

CHANGE ANALYST

1. When all documents have been received for a release or change, they are placed in a folder by the control desk and filed in the Active Bin. (First-in-first-out-except for emergency or priority situations).

2. The analyst will take the next folder, sign and date the job card and be responsible for that job until it is released by Dept. 147.

3. His responsibility includes reviewing all documents for correct part numbers, notes, EC level, etc. using a check list as a guide. He is also responsible for obtaining the signatures of Manufacturing Pre-Analysis and Factory Service representatives and CEWS Approval, all necessary for the release of the package.

4. Should the card be placed on Hold in Dept. 147, the analyzer notifies the originating lab of the problem.

RELEASE

Released by Department 147 -

Package has been processed by Department 147 and forwarded to Release Documentation, Department 447 for microfilming and ECN tape preparation and distribution.

Released to Production -

Package has been processed thru Department 447 to Dept. 601 where plates are made and hard copy distribution has been mailed to all locations.

Release -

Initial release of SLT Card is when Production Control receives hard copy of release or change.

HOLD

Activity cannot be completed because of problem or error in documents. Hold Notice is sent to controlling lab and job placed in Hold File until problem has been resolved.

See Figure - 1

DOCUMENT INFORMATION CHANGE

Minor correction made to documents must be corrected on next change.

See Figure - 2

WASHOUT

Used when an EDT error requires a recycle. Records are deleted from DCC computer system allowing card to be rerun. May be at same or new EC number. Authorization to Washout a job must come from controlling lab and sent to Dave Grummons, Department 147.

EMERGENCY

Emergency is the highest priority. This status reflects a condition where the product manufacturing line is stopped and a customer machine shipment schedule is in jeopardy.

Endicott plants capacity to handle this type of job, is limited to one per day. Job must have approval of one of the following: C. L. Harris or R. M. Schlauder.

STATUS CHANGE

The only time new documents are required on a change in status is from obsolete to active. Only a notice will be processed to change the status of a card from:

1. Active to obsolete
2. Active to field use
3. Controlled to active
4. Controlled to obsolete

The originating lab sends a work request to Department 147 requesting a change of status. A change of status may reflect one or more part numbers. The originating lab should also:

1. Request a "Where Used" from Endicott.
2. Obtain all users prior approval.
3. Provide input to CEWS for their approval.

Hold Notice AND Problem Report

TO		PART NO	E.C. NO/LEVEL
DEPT.	LOCATION	MACHINE	LOCATION
FROM		TECHNOLOGY	DATE ON
DEPT.	EXTENSION	DATE OFF-1ST HOLD	DATE OFF-2ND HOLD

COMMENTS:

Complete All Columns for All Technologies

	CATEGORY	DETECTION	DOCUMENT	PROBLEM	ACTION
1st Hold					
2nd Hold					
	1. E. C. CAUSING 2. SUSPENSE 3. PRIOR TO RELEASE	1. LAB OF CONTROL 2. ENDICOTT PROC. 3. CONTROL DESK 4. TEST 5. MANUFACTURING	A. ALD B. ASM DWG C. CEWS/CCUF D. EDT/GPI E. SCHEMATIC F. EPOC/WORK REQ G. WIRE LIST H. REWORK INS/DOC J. LMT/LTD K. CKT FLYER L. ENG. SPEC. M. CMT/CLT X. OTHER (SPECIFY)	A. APPROVAL B. MISSING C. INCOMPLETE/IN ERROR D. CORRECTED E. UNRELEASED F. INTERCONNECTIONS G. COMPONENT H. DISPOSITION J. E.C. #/LEVEL K. P.A. PROGRAM (739) L. ORIGINATOR X. OTHER (SPECIFY)	A. CANCEL B. DELAY C. DOC. INFO. (SUSP.) D. NEW E.C. E. RECYCLE (739) F. WASH OUT— #____

IBM FORM 624-9171

ORIGINAL

Figure 1. HOLD NOTICE and PROBLEM REPORT

DOCUMENT INFORMATION CHANGES

TO: Name ____________
Dept. ____________
Location ____________

Card Asm. ____________
Raw Card ____________
EC ____________
Card Size ____________
Date ____________
Analyzer ____________
Phone ____________
Dept. 146, Endicott

Information has been changed on the above documents. These changes MUST be incorporated into your history file for possible future change activity. The document changes are as follows:

Information on the E.D.T. was changed and must be incorporated in your next Engineering Change, as follows:

Copies to: Packaging Group named above
History Folder (Dev. only)
Analyzer
Record file (Master)

146-2 12-22-64

Figure 2. DOCUMENT INFORMATION CHANGES

TRANSFER OF CONTROL

SCOPE

The following procedure will establish the instructions for transferring control of SLT cards from one laboratory to another.

FORMS

The laboratory of control making the transfer will supply information on the CD Engineering Work Request (4 copies) according to Section 1 of this Suffix.

PROCEDURE

Using the proper form as described above, the following information must be given: (See Figure 1 attached)

A. 1. Lab making transfer
2. Lab receiving transfer
3. Individual making transfer
4. Individual receiving transfer
5. Date transfer will be effective
6. List all documents - tapes or other information including suspense notice changes and document information changes that are to be transferred.
7. Indicate performance level of card being transferred.

NOTE: All suspense and document information changes must be included in the next EC.

The documents normally involved in a transfer of control are as follows:

Original multicolor and manual DA input documents if available.
Card Flyer LMT - need only contain transferred part numbers.
Card History Tape (CHT) - need only contain transferred part numbers.
Brownline of latest level circuit flyers.
Suspense Notice Change,* if any exists.
Document Information Change,* if any exists.

* Issued by Dept. 147

B. One copy of the Work Request should be sent to Department 147, Bldg. 676, attention of Mr. J. Paukett.

C. Three copies should be sent to the individual receiving the transfer. One copy should then be signed, dated, and forwarded to Department 147 as acceptance of transfer. Another copy should be returned to the sender to confirm receipt of the transfer.

D. Department 147 will post its master control cards showing new lab of control upon receipt of its signed copy of the work request from the individual receiving the transfer.

E. A work request is not required for each card if several are to be transferred at one time. List all items on an attached sheet.

F. Do not request a transfer of control while a card is on engineering change in Department 147.

G. It is the responsibility of the individual making the transfer to notify the local DA Group so that the card history tape (CHT) and the LMT may be sent to the new lab of control.

H. It is the responsibility of the individual making the transfer to delete the ALD from the local LMT after receipt of confirmation from the receiver.

I. It is the responsibility of the individual receiving the transfer to immediately process the ALD through their DA Group to update their LMT history. The new lab of control will then appear in the next CALM listing.

CD ENGINEERING WORK REQUEST

SHEET ____ OF ____

RAW CARD PART NO. ①	INT. PLANE NO. ②	ENG CHANGE NO. ③	ASSEMBLY NO. ④

CIRCUIT		PACKAGING CYCLE		
INVESTIGATED BY ⑤	APPROVED BY	START DATE ⑦	DAYS ON HOLD	CHANGE ACTIVITY CODE ⑧

PACKAGE		
INVESTIGATED BY ⑥	APPROVED BY	ACCOUNT NUMBER ⑨

LOCATION PRE ANALYSIS		
MANUFACTURING ⑩	TEST	IPT / PURCHASE ORDER ⑪

	NAME	DEPT	PHONE	LOCATION	DIVISION	DATE
TO	⑫					
FROM	⑬					

PROJECT NAME ⑭ ⑮	DIV. S&R CHARGE ED / CD	PROD. CODE ⑯	MACHINE TYPE ⑰	SYSTEM ⑱
TECHNOLOGY ⑲	CIRCUIT FAMILY ⑳	CIRCUIT NAME ㉑		CARD SIZE ㉒

☐ NOT REQD	VOLT	PINS	NOTE:	VOLT	PINS	DATE REQUIRED
INT. PLANE: GD ONLY ☐						MODEL CARDS ㉓
VOLT GD ☐						
☐						PRODUCTION
☐						

㉖ DISPOSITION	ASSEMBLY	RAW CARD	STOCK STATUS & DATE ㉗	USER APPROVAL ㉘ ☐ OBTAINED ☐ NOT REQUIRED
REPLACES ㉙		SIMILAR TO ㉚		PERFORMANCE LEVEL ㉛

REASON FOR CHANGE:

㉔

CIRCUIT FLYER CHANGES REQUIRED AND FC:

㉕

DISTRIBUTION:

1. FORWARD ORIGINAL TO: CD DEPT 147 PO BOX 6 ENDICOTT N.Y. ATTENTION: ____
2. FORWARD COPIES TO: MACHINE GROUP, CIRCUIT PACKAGING, PRODUCT ENGINEERING

REQUEST APPROVED BY (MANAGER) ㉜

ATTACHMENTS:

☐ CEWS FORM (COPY)

☐ WAIVER LETTER

FORM 624-8127

1.0 SCOPE.

This practice outlines the procedure for the obsolescence of any card part number.

1.1 SLT/SLD CARD OBSOLESCENCE PROCEDURE

1.1.1 STEP I (originator)

Originator contacts Packaging Manager at the lab of design control for that part number to be obsoleted. If practical an Endicott (01) seven level where used should be included.

1.1.2 STEP II (Packaging Manager - controlling location)

1. Receives request to obsolete a particular part number (s).

2. Contacts controlling group and obtains approval to obsolete.

NOTE: Machine group must get user's approval.

3. If scrap disposition on card, places card on production hold in Endicott by notifying Factory Services, Dept. 307, Endicott.

4. Sends one copy of CEWS input form to Dept. 519, Endicott, and another copy of CEWS input form is sent to the control desk, Dept. 308, Endicott, with work request.

5. A work request is required to be sent to the control desk, Dept. 308, Endicott. The following information MUST be noted when processing the work request in the normal manner:

   a. The user's approval block must be checked.

   b. The work request must contain part numbers of one machine type only (one EC number per work request)

   c. If the card being obsoleted can be reworked into another card, the other card part number and its EC level MUST appear on the work request. In this instance, Factory Services, Dept. 307, Endicott, must be notified by the packaging area in the originating location so that rework drawings can be made.

5. d. If the card ASM being obsoleted has been or will be replaced by another card ASM the P/N of the new ASM must be indicated on the work request.

   e. If the card ASM being obsoleted is similar to another card ASM the P/N of this card ASM must be indicated on the work request.

6. Notifies DA in their location to:

   a. Update LMT to reflect obsolete status in comments section of the ALD for the CALM listing update.

   b. Remove assembly ALD information from the CMT.

   c. Remove P/N from active SCHT (Small Card History Tape) and place on a history or obsolete SCHT.

1.1.3 STEP III (Control Desk - Dept. 308)

1. Logs in work request and CEWS input form.

1.1.4 STEP IV (Analyzer - Dept. 147)

1. Signs job out from the control desk.

2. Orders 7 generation where used from express.

3. Fills out forms:

   a. POC

   b. Machine type reference

   c. OLPU (other lab plant usage) using 7 generation where used.

   d. Pre-analysis check sheet.

   e. Engineering Notice - to include:

      (1) ASM & RC number, artwork levels

      (2) Disposition - if scrap, verifies that card is on production hold.

      (3) Endicott and Mechanicsburg stock status.
      NOTE: When Endicott stock status is received from production control, Endicott, the analyzer makes sure card assembly is on production hold and there are no open orders against the P/N.

(4) Originating lab, labs affected (using OLPU form).

(5) Scrap and rework account number (each location has one).

(6) CEWS number.

4. Holds job until CEWS form #5 (CEWS Approval Form) is received from Dept. 519, Endicott.

1.1.5 STEP V (Pre-analysis, Endicott Test Equipment Engineering - CD Process Engineering)

1. Receives obsolete package with all forms completed.
2. Checks package.
3. Signs pre-analysis check sheet.

1.1.6 STEP VI (Analyzer, Dept. 147)

1. Receives package from pre-analysis.
2. Sends package to Dept. 308, file room.

1.1.7 STEP VII (Dept. 308, File Room)

1. Receives obsolete package.
2. Pulls documents from history files and stamps all documents obsolete in red, adds EC level, refiles documents.
3. Posts obsolete status in the card file and EC number assignment books for each P/N being obsoleted.
4. Posts P/N of card assembly being obsoleted on daily release sheet.
5. Sends obsolete package (EC Notice, distribution list, POC form, and OLPU form to Dept. 447).

1.1.8 STEP VIII (Release Documentation, Dept. 447)

1. Receives obsolete package.
2. Microfilms obsolete package.
3. Removes obsolete P/N's from express tape and adds these P/N's to obsolete tape.

4. Sends Engineering Change Notice tape to labs and/or plants affected so that express functions throughout the corporation can change the status of the parts being obsoleted.

1.1.9 STEP IX (Dept. 308, File Room)

1. Receives package.

2. Files package.

1.1.10 STEP X (Production Control, Dept. 504)

1. Fills out form with obsolete P/N (from daily release sheet) and sends to Depts. 107, 207, 515, 519, 739 so that these departments are notified of obsolete P/N (for destroying glass, drill tape, test tape, etc.)

1.2 TO REACTIVATE AN OBSOLETE PART NUMBER (ORIGINATOR)

1.2.1 1. Requests SCHT and LMT of P/N involved from last controlling lab to be sent to the DA area in his location. (Follow transfer of control procedure, if applicable).

2. Notifies his DA to update these tapes and release the obsolete part number at a new EC level in an active status.

3. Follow normal release/change cycle.

SCOPE

Problems are sometimes experienced by SMD or CD during manufacture, assembly, testing, etc. of SLT cards. The Factory Service personnel (Dept. 307) receive those problems requiring an engineering solution or assistance. This group will make an analysis of the problem, establish liaison with the Lab of Control and provide them with a solution.

Many of the problems are solved without change to the engineering documentation for the particular card. However, some solutions require documentation changes and these requirements are defined in this section.

All physical rework to an SLT card must be made in accordance with Engineering Specification 890926.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

DEFINITION

A Suspense Notice (form 307-6) is issued by card part number to advise of minor document discrepancies. A formal Engineering Change is not justified but the problem must be defined and corrected by the next Engineering Change processed.

PURPOSE

The Suspense Notice serves to provide immediate documentation to SMD or CD in the areas of Manufacturing, Production Control, Test Engineering and Quality Control. WTC Manufacturing is also advised.

Types of discrepancies covered (not a complete list):

a. ALD and artwork correct but module input incorrectly labeled on schematic.
b. Polarity identification missing or component value error on schematic.

PROCEDURE

1. Factory Service personnel (Dept. 307) investigate the problem and prepare the Suspense Notice.

2. A copy of the Suspense Notice is sent to the Lab of Control where it is entered into their history file for that part number. The next Engineering Change processed on this card must include the Suspense Notice correction.

3. All Engineering Changes processing through Dept. 147 are reviewed for history, and the package will be rejected if the correction has not been made.

SUSPENSE NOTICE

SUSPENSE INFORMATION

TO: Name
Dept.
Location
Date

1. Suspense No.
2. Card Asm. 580
3. Raw Card 58 Level
4. E.C.

5. These changes MUST be incorporated into your history file for possible future change activity.
The document changes are as follows:

6. Analyzer
Phone
Dept. 307, Endicott

Telex 1 thru 6 to:

Mr. M. Zuccarelli
Dept. 781
Corbeil Essonnes
France

Mr. H. Ehlert
Dept. 113
Sindelfingen
Germany

Analyzer
Dept. 307

Copies to: Packaging Group named above
Analyzer - Master

ENDICOTT

M	Crowe	-107	Bldg. 623-1
L	Lanskey	-207	Bldg. 623-1
R	Foland	-689	Bldg. 018-1
J	Kunta	-023	Bldg. 018-1

OWEGO

E. Fabrizio	-317	Bldg. 002-2
J. HeimGartner	-314	Bldg. 002-1
S. Kimball	-259	Bldg. 002-2

307-6 2/29/68/1mb

DEFINITION

An Advance Engineering Change is a complete set of marked card assembly documents issued to Manufacturing in advance of the formal Engineering Change to provide Manufacturing with the information required to correct a discrepancy or to incorporate a simple design change without holding production.

PURPOSE

The purpose of the Advance Engineering Change is to provide updated documents to Manufacturing to permit continued production.

EXPLANATION

The Advance Engineering Change package is established to handle discrepancies in:

a. Raw card circuitry.
b. Component coding between schematic and assembly drawing. (Assembly errors only)
c. Component part number wrong on Bill of Material and/or assembly drawing.
d. Emergency design changes affecting part numbers.
e. Emergency logic changes - (Not extensive)
f. Addition and/or removal of components.

PROCEDURE

When the necessity for issuing an Advance Engineering Change arises, Factory Service personnel (Dept. 307) will proceed as follows.

a. Review the discrepancy.
b. Notify the Lab of Control of the problem and the recommended course of action. The Lab of Control is responsible for double checking the problem and solution against the original design.
c. Upon receipt of a new Engineering Change number from the Lab of Control, Dept. 307 will issue an Advance Engineering Change package containing marked-up masters indicating the corrections to eliminate the discrepancy by reworking the assemblies and raw cards to the new Engineering Change level.

PROCEDURE (continued)

c. Continued -

In the event the new Engineering Change number is not supplied by the Lab of Control to Dept. 146, Factory Service personnel, within 4 hours, the Factory Service personnel will issue a new Engineering Change number, and notify the Lab of Control of this action and the number issued.

REQUIREMENTS OF THE ADVANCE ENGINEERING CHANGE PACKAGE

The Advance Engineering Change package consists mainly of the Engineering Notice which explains what is changed, why it is changed and the disposition of parts. In addition there is a set of corrected documents indicating how the correction is accomplished.

Manufacturing will use the Advance package to make all alterations as indicated so the card assembly will perform to this latest functional level. These alterations are controlled manually and without benefit of the EDT numeric data.

ENGINEERING CHANGE NUMBER

The new Engineering Change number will appear on all documentation in the Advance Engineering Change package. The same Engineering Change number must also appear on the formal follow-up documents.

PACKAGE CONTENT

The formal follow-up Engineering Change documents must be exactly the same as the Advance Engineering Change. This means that all component coding, positioning and component part numbers must be identical in both the Advance and follow-up Engineering Change package. The only exception to this is an artwork change being made to comply with ground rules. This can be accomplished so long as the pin assignments remain the same and the raw card level is raised on the formal documents.

Since both packages must be identical, it is the Lab of Control's responsibility to analyze their cards for additional errors or corrections which could be picked up by the Advance package. The Lab of Control should notify Dept. 146 Factory Service personnel of these additional corrections, as they can be incorporated in the Advance package.

TIMING

The formal follow-up change must be processed to Dept. 146 immediately (1 week for minor changes and 4 weeks for redesign of a card) after Lab of Control has been notified, to minimize hand planning and control in Manufacturing.

ADVANCE MARKED PRINT CHANGE - SPECIAL CONDITION

EXPLANATION

To correct an error not picked up in an issued Advance Engineering Change, it will be necessary to process another Advance Engineering Change at a new formal level.

PROCEDURE

The Factory Service personnel (Dept. 307) will handle this in the following manner:

a. When it is discovered that the Advance Engineering Change (161xxx) contains an error, Engineering Change (161xxx) must then be formally released.

b. Upon request, Dept. 307 will release Engineering Change 161xxx as a formal change. The Notice will state - Advance E.C. 161xxx is incomplete, or is incorrect, do not build, further rework is required and will be furnished by E.C. 162yyy. The Notice will also state that Engineering Change 161xxx will not be followed up with an Engineering Description Tape.

c. The Lab of Control must issue another change number 162yyy so that Advance Engineering Change 162yyy can be issued by Dept. 307 to cover the original rework and the error. Engineering Change 162yyy Notice will state the rework accomplished by E.C. 161xxx and E.C. 162yyy. After this has been done, the Lab must submit a formal change package at the same change level as the Advance (162yyy) to Dept. 308 for processing.

d. If another problem arises after Advance E.C. 162yyy has been issued, the cycle described above must be repeated.

e. All Engineering Change numbers used for Advance Engineering Changes, including those released for records purposes, must be carried as history on the EDT for record purposes.

f. Work Requests, or Telexes must be issued to release a package for record purposes only. The Work Request must state, "for record purposes only, to be handled by Factory Service personnel (Dept. 307)."

g. The above conditions A thru F must be followed in the majority of cases, however, as each condition arises, Dept. 307 personnel will analyze the problem and attempt to take corrective action without the processing of a second E.C. It must be emphasized that this corrective action only will

PROCEDURE (continued)

be taken when conditions warrant:

Examples:

a. Advance prints can be called back from distribution.

b. No other locations are affected and Endicott stock can be controlled.

c. A Notice Only suffix change cancelling Rework (to be issued later with Formal Change) is deemed acceptable.

In all instances this action requires approval from all personnel affected.

h. It is strongly advised that when the Lab of Control is first notified of an error that they check the card assembly completely for additional problems that could be corrected in the change.

MARKED PRINT FORMAL CHANGE

DEFINITION

A marked print formal change is defined as an Engineering Change containing documents marked up to serve as a tool for limited design changes, but cannot be followed up by an identical Engineering Description Tape (EDT).

PURPOSE

The purpose of the marked print formal change is to provide temporary documentation to the Manufacturing facility. However, these documents are marked in such a way as to incorporate only the design change(s) for those cards being currently produced by Manufacturing.

EXPLANATION

The marked print formal change is used to make design changes in:

a. Raw card circuitry.
b. Component coding between schematic and assembly.
c. Component part numbers on the B/M and/or assembly drawing.

The changes may necessitate the marking of documents in such a manner as to make it impossible to process an identical follow up change. For this reason, this E/C must be processed as a rework E/C in itself.

This condition necessitates the processing of the marked print formal release as a separate package to clear the cards in Manufacturing and provide identity for the card assembly test program at the marked print level.

The follow-up EDT will be identified by a new Engineering Change number; however, the Engineering Change number used to identify the marked print release must also be included as history in the Engineering Change block.

DEFINITION

A raw card marked print is a marked document supplied to Manufacturing to correct a non-functional discrepancy in the raw card documentation. It is identified by a new Engineering Change number, but is not processed through the normal release process and is not accompanied by an Engineering Notice.

PURPOSE

The purpose of the raw card marked print is to supply to Manufacturing updated information and enable them to produce correct raw cards without Production delays.

EXPLANATION

Error Categories

All raw card marked print corrections will be supplied to Manufacturing by Factory Service personnel (Dept. 307).

The error category covered by the raw card marked prints are:

a. Note code calls out incorrect grid locations.
b. Note code calls out incorrect hole size.

Action Required

When the necessity for supplying a raw card marked print correction arises, Factory Service personnel (Dept. 307) will take the following action:

a. Notify the Lab of Control of the problem and what action will be taken.
b. Upon receipt of a new Engineering Change number from the Lab of Control, Dept. 307 will supply the marked print to Manufacturing to enable them to build the raw card to the new Engineering Change level.

A good reproducible brownline copy of the raw card marked document, along with a memo, is sent to Production Control, Dept. 503 in Endicott Manufacturing, France, and Germany. Manufacturing will use the marked documents to make the alterations so the card will be built to this latest level.

CONTENT

It is of the utmost importance that the follow-up package be exactly the same as the raw card marked documents. Component coding, positioning and component part numbers must be identical in the formal follow-up package. The only exceptions are artwork changes to comply with ground rules, so long as the pin assignments remain the same and the raw card level is raised.

Since the follow-up package is identical to the raw card marked documents, it is the Lab of Control's responsibility to analyze the card for other discrepancies which should be included in the raw card marked documents and the follow-up package.

TIMING

The formal follow-up change must be processed immediately (1 week) to minimize hand planning and control of the card through Manufacturing.

IBM Division Engineering Practice

REWORK DRAWINGS PROVIDED WITH FORMAL CHANGE PACKAGE

DEFINITION

Rework drawings, whenever possible, are supplied with a Formal Change package in place of a separate Advance package.

PURPOSE

To provide Manufacturing and Distribution with Rework documents E.C. compatible with Formal change without the necessity of a separate (Advance) package. This procedure can be done only:

a. If time allows
b. If Rework is identical to Formal package.

PROCEDURE

When requested to provide Rework documentation to Manufacturing, Dept. 307 will: (A) Determine the urgency of this Rework; (B) Determine the feasibility of providing Rework documentation with the Formal change.

If both conditions are met, the appropriate documents will be manually marked showing all changes such as is done in an Advance Rework change. These documents will be included with Formal automated updated documents in the change package.

CONDITIONS

It must be emphasized that urgency of Rework must not be great, and Rework <u>must</u> agree with Formal changes as outlined for Advance Engineering Changes. (See Section 2) Also, conditions which delay the processing of the Formal change thru Dept. 147 play a decisive role. If it is required to washout a Formal change or for any other reason greatly delay this change, a separate Advance Rework change must be processed.

IBM Division
Engineering Practice

SLT CARD ASSEMBLY
DISCREPANCY NOTIFICATION

DEFINITION

This form (307-5) is used to record all discrepancies received from Manufacturing Process areas, Packaging or Machine Groups, or Receiving Inspection areas.

PURPOSE

To record, control and notify affected areas or groups of the discrepancies to be investigated by Factory Service personnel (Dept. 307).

PROCEDURE

1. Record discrepancy on form 307-5 (See example Page 3 Section 6)
2. Investigate discrepancy
3. Action required to clear the discrepancy is:

   a. Suspense Notice
   b. Advance Marked Print Change
   c. Marked Print Formal Change
   d. Raw Card Marked Print Change
   e. No action required by Engineering
   f. Production Hold - Formal Change required

Distribute Form 307-5 to:

a. Lab of Control (confirmation of phone or Telex notification)
b. Testing
c. Manufacturing Engineering - France } Telex
d. Product Engineering - 113- Germany }

The disposition of the discrepancy will be indicated on the form.

Document, or design discrepancies resulting in production being scrapped must be approved for "Production Hold" by a Manager in Dept. 307.

SLT Card Assembly Discrepancy Notification

5. REASON:

1. Notification No.________
2. Asm. No.________
3. Raw Card________ Level________
4. E.C.________
Call Rec'd By________ Dept. 307
Date________ Phone________
Trouble Reported By________
Dept.________ Date________
Lab of Control________ Date Notified________
Trouble Reported To________
Dept.________ Date________ Phone________
Action________
Date________
207 Notified________
Red Line Card?________ Card OK________
Scar Input________
To Checking________
To Typing________
To Final Sign-Off________
To 308________
Account No.________
Performance Level________
CEWS No.________
Users Approval________
On Hold________ Off Hold________
9. Factory Service Analyzer________

Authorized Hold________ Date________ Dept. 307 Phone________

TELEX: Item to be included in telex are 1 - 9

Mr. M. Zuccarelli
Dept. 781
Corbeil Essonnes
France

Mr. H. Ehlert
Dept. 112
Sindelfingen
Germany

6. Action, Type of
   "W" Hold for Engineer Invest.
   "X" Hold for EC________
   "Y" Remove from Hold
   "Z" Rework instructions mailed
7. Kind of E.C. ___ Advance
   Suffix ___ Marked Prints
8. Dispos. (Tentative)
   "0" Unknown
   "1" Thru "24" Card Asm________
   Raw Card Asm.________

Mail To:

NAME________

DEPT.________

Location________

Form 307-5

DEFINITION

A complete set of marked card assembly documents must be issued to Manufacturing to provide information for reworking a card assembly of one part number into another part number.

PURPOSE

Reworking of one part number into another part number is done only in two cases.

(a) To salvage large quantities of reworkable stock for cards which are obsoleted.

(b) To satisfy critical machine requirements for the resulting part number via accelerated procurements.

PROCEDURE

When requested to provide documentation for reworking one part number into another part number, Factory Service personnel (Dept. 307) will proceed as follows:

(a) Evaluate the feasibility of the rework.

(b) Notify the lab of control of the decision reached (by Dept. 307).

(c) If the decision is to rework, Dept. 307 will mark up the master vellums indicating the rework necessary to bring the card to desired part number and Engineering Change level.

REQUIREMENTS OF THE PART NUMBER TO PART NUMBER REWORK PACKAGE

The part number to part number rework package consists of the Engineering Notice, which explains what is changed, why it is changed and the disposition of parts. The package also contains a complete set of marked documents indicating the necessary alterations and instructions as to how the rework is accomplished.

Manufacturing will use the marked documents to make the necessary alterations to the cards in order to make them perform to the indicated Engineering Change level. These alterations are controlled manually and without the benefit of the EDT numeric data.

CARD ASSEMBLY AND ENGINEERING CHANGE NUMBERS

The new Engineering Change numbers will appear on all documentation in the package. The new card assembly number will appear on all documents pertaining to the card assembly. The Raw Card P/N will not be changed.

TIMING

If the P/N to P/N rework package is being processed to deplete stock on a P/N that is to be obsoleted, the Marked Prints will be processed with the Engineering Change that obsoletes the part. This can only be done in cases where all stock can be reworked on a one-order basis and should be avoided when it is feasible to include Rework Information in a new Release package.

In cases where the P/N to P/N rework is being processed to expedite emergency requirements for the new P/N, the Marked Prints will be included in the Formal Release Package of the new P/N. The new P/N must be released before or at the same time that the P/N to P/N rework instructions are issued. It is not possible to release a new P/N by virtue of Marked Prints.

SCOPE

This suffix gives a brief description of the main operations used to manufacture standard SLT small cards.

The operations described are listed in the actual Manufacturing sequence.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

The "wet process" or "basic card manufacturing" portion of the SLT standard card panel line is comprised of the following operations.

PANEL IDENTIFIER

This operation puts machine readable notches on the edge of the panel. These notches are used in subsequent operations to perform such functions as:

a. Interrogate the computer for numerical control data.
b. Keep panels in their proper basket group.
c. Dispatch panels to proper machines.
d. Record a history of the panel through the wet process.

COMPONENT HOLE DRILLING

Drills holes for component and pin insertion. Holes are of four possible diameters (.035", .042", .049", .062"). To be drilled on the high speed drill machines, the holes must be on a .025" reference grid.

DRILL HOLE TESTING

Tests the drilling of component holes.

DEGREASING

This operation removes possible organic residue.

COPPER PLATE SURFACE PREPARATION

This operation is comprised of a series of deburring steps.

COPPER PLATING

This operation plates copper on the surface and in the holes of the panel.

PLATED HOLE TESTING

This operation checks the holes for the required plating.

ORGANIC RESIST SURFACE PREPARATION

This operation is very similar to the copper plate surface preparation operation.

RESIST APPLY SURFACE PREPARATION

This operation puts the panel through a number of cleaning operations, and coats the panel surface and holes with black copper oxide.

The description for the rest of the wet process line is that of the direct-resist process.

RESIST APPLY

In this operation, a coat of photo sensitive material is applied.

EXPOSE

In the card panel expose operation, the resist in the holes, on the lands, tabs, and circuit lines on both sides of the panel are exposed to light simultaneously.

DEVELOP

That portion of the resist which was exposed is developed and all other resist is removed, leaving bare copper.

ETCHING

The bare copper is etched away, leaving the card surface bare.

RESIST REMOVAL

The developed resist which is on the circuit lines, and in the holes is removed.

COPPER OXIDE REMOVAL

The copper oxide on the circuit lines and in the holes is removed; this leaves bare copper in these areas.

CARD PANEL TEST

The circuit lines are tested for shorts and continuity.

COPPER OXIDE APPLY

The copper oxide is re-applied to the circuit lines and through plated holes.

This is the last operation in the wet process line.

The "final assembly" portion of the SLT standard card panel line is comprised of the following operations.

PROTECTIVE COATING

The protective coating will be applied, by screen patterns, to the back and front of the cards in panel form.

There are two types of screen patterns; standard and special. When operating on standards, there are few set-ups, whereas specials would require a set-up for each basket. The product output of specials would be much less than for standards.

PANEL NOTCH

The Card Panel Notch Machine will read the panel, program the machine per card size and type, punch tab notches on all cards in each panel, and when required, punch cable card locating notches in the panel.

OXIDE REMOVAL AND TIN IMMERSION

This operation removes and deposits tin on the bare copper.

SLT CARD AUTOMATIC MILLING MACHINE

This machine will mill panels of 1-Hi, 2-Hi, and 3-Hi, 6 pac and 12 pac cards into their individual card form.

The card panels entering this machine have machine readable raw card part number identification in the form of notches in a 2 out of 5 code located along the left panel edge. The panels will be grouped in a known sequence, by hole pattern and card size.

A read station will determine the panel code and compare it to that of the previous panel. If a change in panel code is indicated, the machine controller will program the milling cutters to perform the proper operation. The machine shall be programming its internal functions relative to the panel code.

SLT CONTACT ASSEMBLY MACHINE

This Contact Assembly Machine receives single cards. The copper bits on each card is read to determine its part number

SLT CONTACT ASSEMBLY MACHINE (continued)

from which the number and position of the contacts required is determined. The cards are in a vertical position during the contact and housing operations. The contacts, on reels, are fed into the machine and soldered to the card tabs.

SLT CLEAN MACHINE

The Clean Machine will accept cards singly from the Contact Assembly Machine and remove excess flux.

SLT HOUSING ASSEMBLY MACHINE

In the Housing Assembly Machine the cards are sensed for base size and located in a holding fixture - two 6 pac bases per fixture. The card will progress to one of three housing assembly stations, where the correct size housing is assembled. Each housing station has its own housing input contained in special magazines. This machine has the capability of assembling the following size housings to the appropriate card size.

1. 3 pac housing (cable cards)
2. 6 pac housing
3. 12 pac housing

The machine will hot stamp on the card housing, the year shop date code. This date is the production control production day date. The cards are then transferred to the production card magazine.

STOCK

The stock area will contain SLT cards in production magazines according to raw card assembly part number.

The stock area will contain an inventory of cards. When cards are committed to final assembly production orders, they will be removed from the stock area and merged with their required components.

COMPONENT PREPARATION

SLT Circuit Modules and R/C Modules

Both the circuit module and the R/C module insertion machines require components to be delivered in a redi-pac container in the sequence that they will be inserted into the card.

Loading of redi-pacs will be done by using the slide-pac requisition list delivered by Production Control to determine the location of slide-pacs in the redi-pacs.

COMPONENT PREPARATION (continued)

SLT Circuit Modules and R/C Modules (continued)

Redi-pacs will be designed such that a particular component redi-pac can only be placed on its associated insertion machine. Therefore, each order must contain a separate redi-pac for each component type to be inserted in the card.

Each redi-pac will have man-readable identification to assist the operator in loading the right redi-pac into the machine with a given card order.

Axial Leaded Components

Axial leaded components, which are of tubular construction, will be received from vendors, lead taped on reels. The components in reel form are loaded into the card controlled prep machine. The empty slide-pacs associated with this particular components are also loaded into the machine. Components are then clipped from the reel counted and loaded into the slide-pacs on a per order requirement.

There are two size slide-pacs for axial leaded components. Components, whose body length is between .200 and .300, are loaded in one slide-pac. Diodes, 1/4-watt resistors and a few capacitors and inductors are in this range. Components, whose body length is between .300 and .450, are loaded in a second size slide-pac. Capacitors, 1/2 and 1/8 watt resistor, and inductors are generally in this range.

As slide-pacs exit from the prep machine, they will be identified by component part number and assembly order number of the redi-pac to which it is committed. As the production requirements of a given component insert machine are prepped, the slide-pacs will be manually loaded into the redi-pacs.

Other Components

Other components consist of TO-18 and TO-5 transistors and all hand assembled components. Other components may also be construed to include all components that will undergo manual insertion on the 3-Hi 12 module cards.

TO-56 transistors and diodes in the TO-56 can, will be prepared for insertion by a machine that cuts their leads to specified length, forms their leads, and inserts them into slide-pacs.

All slide-pacs will be forwarded to a redi-pac assembly area where sorting by order occurs. From here the loaded redi-pacs will be sent to the assembly line to merge with the card processing.

COMPONENT INSERTION

Component Insertion consists of an Assembly Number Identifier machine and the Component Insertion machines. The Assembly Number Identifier deletes certain copper bits from the left card edge to achieve machine readable order - E.C. number plus hot stamping man-readable printing on the housing.

All Component Insertion machines include the Card Positioning System and the Card Assembly part number Read Head.

ASSEMBLY PART NUMBER IDENTIFIER

This machine deletes copper bits from a full row of bits, to create a 2 out of 5 bit configuration for order number and Engineering Change level, on the left edge of the card.

Note: The 4 digit card assembly number is already in coded bits on the left card edge. The machine hot stamps a four digit (year, assembly shop date) number on the housing. One alphabetic character is hot stamped on the housing to represent Engineering Change level.

The cards will arrive in production magazines and will be unloaded by a standard input handler. No electrical components will be on the card at this time. After this operation is performed, the cards are reloaded into the same production card magazines.

INSERTION MACHINES

All of these machines are similar and operate identically except for certain exceptions in their insertion operations.

Cards will be delivered to the machine in production card magazines and will be loaded into the input/output handler. The handler will automatically position the magazines for card unloading by the card transport system.

The Read Head will determine the assembly number of the card and the control unit will compare it to the previous assembly number in storage. If there is a change of assembly number, the computer will be interrogated for new machine programming information.

After completion of the read operation, the card will be transported to the positioning table where it will be located and clamped for the assembly operations. The positioning table is capable of positioning the card in two axes, in increments of .025 inches. It is capable of locating, clamping and positioning any of the four card sizes. Also it will locate and clamp the 3 Hi 12 pac cards but positioning will be limited to the 2 Hi 12 pac area adjacent to the housing on the 3-Hi card.

INSERTION MACHINES (continued)

The positioning table will move the card to the proper X-Y coordinates as directed by the control unit. The components will be fed from the redi-pac to the insertion head; and after insertion, will be clinched to the card. This sequence of operations will be repeated until all of the components are assembled to the card.

Axial Leaded Insertion Machines

There are three types of automatic axial leaded tubular component inserting machines.

a. .375 Tubular Component Inserter
b. .500 Tubular Component Inserter
c. .625 Tubular Component Inserter

The basic difference between each machine is the hole spacing into which the leads of the component must be inserted. Diodes cannot be inserted on the .375 inserter. They can be inserted on both the .500 and the .625 machine. It is anticipated that the larger percentage of diodes will be at .500 spacing. The 1/4 watt resistor will normally be inserted on the .375 machine. They could also be inserted on the .500 and .625 machines. Most capacitors, 1/2 and 1/8 watt resistors and inductors are inserted on the .625 machine. Some of the smaller sizes of these components could be inserted on the .375 or the .500 machine.

R/C Module Inserter

This machine will insert a variety of R/C module sizes. These are 2, 4, 6 and 8 leaded R/C modules. Prior to insertion, the component delivery mechanism for this machine orients the R/C module according to the input numerical control data.

TX Semi-Conductor Insertion Machine

This machine will insert transistors (TO-56 size only). The card hole spacing per transistor, does not change. Orientation of the transistor is performed by the machine.

Module Inserter

This machine will insert SLT modules and crimp 2 pairs of opposite leads. The orientation of the module is performed prior to the module transfer to the insertion head.

SOLDERING

Soldering is done by an integrated machine consisting of the Flow Solder Machine and a Clean Line. This machine will process all SLT card types including the 3 Hi 12 pac cards. All cards will be received in standard production magazines and have their correct complement of wettable components.

After solder, if manual assembly of non-wettables is required, the production magazines will go to that area. If not, the cards in production card magazines are delivered to the Testing operation.

This section will define the purpose of SLT small card final testing; explain the procedures and types of equipment involved; and present a flow chart indicating the various paths an SLT small card might take within the card test area.

For a complete definition of SLT small card layout and circuit representation rules pertinent to card testing, see Suffix 3.

PURPOSE OF FINAL TEST

Final testing of SLT small card assemblies provides manufacturing with card defect sorting and error diagnostic capability. This allows shipment of acceptable quality cards at the most economical cost.

Without this final test operation, card defect levels could range up to about 20%. This would place systems test and field stock operations in an untenable position; i.e. no way to analyze or repair defective cards. Hence, all cards leaving manufacturing must pass a functional test and defective cards must be analyzed and reworked.

In this respect, cards which are not testable in manufacturing are not manufacturable. Every effort should be made to package and represent card circuitry so as to facilitate testing and analyzing of defective cards in manufacturing.

TEST CLASSIFICATION OF SLT CARDS

For purposes of defining test procedures and establishing basic routing of cards through the manufacturing final test facilities, each SLT small card is placed into 1 of 8 classifications. These eight classifications are defined as follows:

Class I - Combinational Logic Circuitry

Cards falling into this class contain circuitry in which the output states are always determined uniquely by a single set of input states, i.e., no latch-backs on the card.

Class II - Sequential Logic Circuitry

Cards falling into this class contain circuitry in which the output states are not always determined uniquely by a single set of input states, i.e., one or more latch-backs on the card.

TEST CLASSIFICATION OF SLT CARDS (CONTINUED)

Class III - Passive Circuitry

Cards falling into this class contain resistor nets, capacitors, etc.

Class IV -

Cards falling into this class contain circuits requiring a time dependent function as an input or providing one as an output, These cards, which usually require wave form testing, are core drivers, sense amplifiers, oscillators, single shots, etc.

Class V -

Cards falling into this class are logic circuit cards (class I and II) having circuit output notes which are not available at card contact springs. These cards may require additional test operations to guarantee established card quality levels.

Class VI -

Cards falling into this class contain exotic circuitry requiring one or more of the following:

1. Wave form testing more exacting than may be accomplished on standard test equipment. (The limitations of the standard test equipment are covered in section .

2. The changing of components at the card test equipment for circuit alignment.

3. The tuning of delay lines by external jumping.

4. The adjustment of a potentiometer to a point and fixing it in place.

Class VII -

Cable termination cards without components.

Class VIII -

Cable termination cards with components.

Card classes I, II, and III can be completely tested automatically on a computer-controlled test system. Card classes IV, V, VI and VIII can only be partially tested on the computer-controlled test system and may require routing to off-line test equipment to complete card test requirements.

AUTOMATIC TEST EQUIPMENT -

Introduction -

Standard logic cards, Classes I, II, and III, will be tested on an IBM 1410 DPS (hereafter referred to in this section as computer) controlled test system which has been designed to operate completely automatically. The computer will control the entire test system, apply all test stimuli, make all logic decisions and provide error diagnostics. Automatic card handling, together with automatic testing and diagnostics, will allow a throughput of one card per second for test and analysis.

The card set-up, test, and error diagnostic information for standard cards tested with this system are computer generated from circuit flyers and ALD information. There are no pre-wired program boards or plugboards as will be necessary with test equipment used to test special cards.

Faulty cards will be ejected from the system and directed to a rework area together with a computer-generated diagnostic telling the rework personnel what part or parts to replace on the card.

Equipment -

The computer uses a 1411 Central Processing Unit (CPU) with an 80K core storage, and a 1415 Console. Connected to Channel 1 of the CPU are four 1311 Disk Packs and a 1414 I/O Synchronizer for use with a 1403 Printer and a 1402 Card Reader/Punch. The test equipment modules are connected to a Corporate Standard Interface on Channel 2 of the CPU by an I/O Adapter. The I/O Adapter serves to inter-connect a particular tester to the computer when the tester requires service. This is accomplished through a polling technique which is part of the computer programming routine. Connected to the I/O Adapter is the part number reader, the shorts tester, the impedance tester and the logic tester.

An automatic handling system is used to transport the SLT cards through the system. The handling system is modular in design and consists of input handling equipment, four identical handler modules (one for each of the three testers and one for faulty card ejection) and output handling equipment.

Input Handling Equipment -

The input handling equipment is used to automatically insert cards one at a time into the test line.

Part Number Reader -

The part number reader enters into the computer the part number and E.C. of each card lot entering the system. This is accomplished by sensing the holes in a punched card carried in a special adapter which preceeds each part number order.

Handler Modules -

The handler module provides for automatic insertion of each card into a test socket which is interconnected to the test unit. It also serves as a transport to move cards to the next handler and to eject cards at the eject station under computer program control. Eject cards are then reloaded into magazines along with the computer-generated error diagnostic printout or routing.

The handlers operate asynchronously from each other, thus allowing full utilization of the computer. This means that a card can be under test at one test station while another card is being moved into test position on another handler.

Output Handling Equipment -

The output handling equipment serves to mark acceptable cards with an acceptance mark and facilitate loading them into shipping containers.

Operation -

Test and Diagnostic Information Input

All test and diagnostic information is entered into the computer on the 1311 Disk Packs. The test equipment will receive these Disk Packs from the Document Control Center. It has been estimated that these packs will contain test and diagnostic information for approximately 4000 released card types.

SLT Card Assembly Flow Through Tester -

Card part number orders will be fed into the system; the part number and E.C. of each card order being entered automatically by the part number reader.

The handler modules automatically transport the cards through the associated test stations. When a card enters a handler module, a mechanical buffer pushes it onto a turn table that rotates it 180°. From the turntable, the card is transported to a test table where it is indexed 90° to the test socket. The card is automatically plugged into the test socket and the handler generates an attention signal to the computer indicating that a card is ready to test. The computer then applies the required tests for the particular part number. Test results are received by the computer for analyzing, after which the computer transmits either a card-accept or a card-eject signal to the handler module.

If the card is accepted, it is held on the test table until the table rotates another 90° and then is transported off of the test table back into the test line via another mechanical buffer and on to the next handler module.

If the card is designated for ejection, its serial position in relation to the cards currently in the system, is noted and the diagnostic information placed into storage. No further tests are applied to this card.

All eject cards are ejected at the fourth handler which is used for sorting accepted and defective cards. Here the computer-generated error diagnostics for the eject cards are printed out on a high speed strip printer. The paper strip containing the diagnostics for all the cards in a given magazine is automatically cut and inserted into a spring clip on the magazine. The eject cards are then routed to the rework area, repaired, and returned for retesting.

Shorts and Opens Tester -

At the shorts tester, every combination of two contacts is tested, for a total of 1128 tests on a 48-contact card. This tester looks for solder shorts which are detectable at the contacts. The shorts are transmitted to the computer and, based on the programmed information for the particular part number, the computer can determine whether the detected shorts are or are not legitimate.

The computer can also determine if an open exists between two pins that should be shorted. In case of a fault, the computer identifies for the high-speed strip printer the two contacts that are affected and whether the fault is an open or a short. Using this information, the card rework area area can repair the card and return it to the tester for retest.

Impedance Test -

At the impedance tester, discrete DC resistance and capacitance measurements can be made between any two contacts. For resistance measurements, the computer addresses the two contacts which are to be checked, the resistance measurement is made, and the results are transmitted to the computer. The computer then determines the component on the card which is at fault if the resistance measurement is outside the required range. Capacitance measurements are made in a similar manner. The main fuction of the tester is to detect card faults which are not adequately checked or analyzed in functional test. These faults include shorted input diodes, missing collector load resistors and missing or defective decoupling capacitors.

Logic Tester -

At the logic tester, power supply voltages are applied and the card is tested for single failure analysis to ensure that it performs the operation indicated by the ALD representation. The power supply voltages are held to 1% tolerances. The input voltage swings are held at minimum specified values and the outputs are checked with a maximum rated load. A card which is accepted at the logic tester is transported onto the output handling equipment where it is marked as acceptable and shipped. A card which is to be ejected is also transported onto the output handling equipment where it is loaded into an eject magazine with the associated diagnostic printout.

OFF-LINE TEST EQUIPMENT

Introduction -

Semi-automatic or manually-operated test equipment (referred to as Off-Line test equipment) may be used for production testing and error analysis of cards falling into Classes IV, V, VI, and VIII to guarantee the quality of such cards which cannot be completely tested on SCFTS.

Cards which require manual testing and error diagnostics due to the nature of the circuitry may cost 10 to 20 times more to test and analyze than cards that can be tested and analyzed on the computer-controlled test system. In addition, programming costs will be 10 to 20 times more than programming costs for computer generated test programs for cards falling into card Classes I, II, and III.

Equipment

The testing of Class IV, V, VI, and VIII on off-line testers primarily involves checking the functional operation of the cards. The tester provides the proper input stimuli at worse-case levels, proper output loading at worse-case values, and the checking of output voltage or current levels and wave shapes.

OFF-LINE TEST EQUIPMENT (CONTINUED)

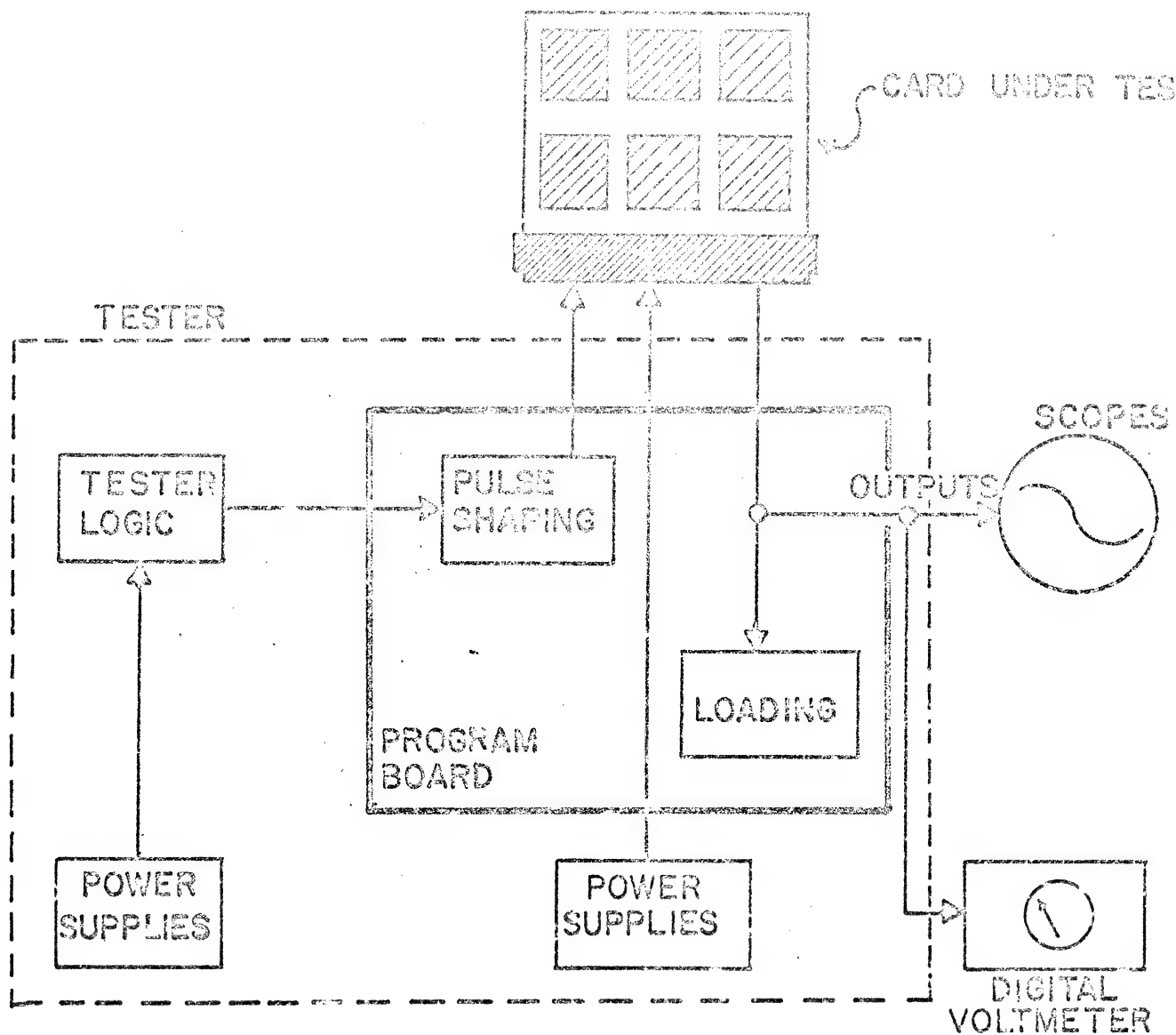



Figure 1. TYPICAL BLOCK DIAGRAM OF OFF-LINE TESTER

The program set up for testing a particular card type with a Class IV (off-line) tester is usually accomplished with an interconnecting wired plug board or program board. These boards contain jumper wires, electronic components and, in some cases, test circuits. The usual functions of the program board are as follows:

1. Connecting the proper supply voltages to the SLT card contacts.

2. Generating and applying proper signals to the card input contacts. (These may be special pulse trains, wave forms or voltage levels.)

3. Connecting card outputs to sensing devices, e.g., oscilloscopes, digital voltmeters, level detectors.

4. Performing programming requirements related to tester circuit operations, e.g., ring drive frequencies.

An individual program board is usually required for each different card type.

The Class IV testers may also use plug-in adapters (sometimes called Master Program Boards). These tend to make the testers more flexible by holding test circuitry that is common to many card types. This test circuitry would otherwise have to be duplicated in the individual program boards.

Operation -

Pretest set up for the tester usually requires the insertion of the proper program board into the tester for the card type to be tested and the set up of any necessary output sensing devices such as oscilloscopes. The set up instructions are a part of the test procedure which is provided for each card type. This test procedure is prepared by the test equipment programming group at the time the card is released for production.

Each card is individual inserted into the test receptacle. The operator must then check each output contact for proper wave shape and/or voltage levels. If a card passes the required test, it is marked with an acceptance mark. If it is rejected, it is placed with other reject cards to be analyzed.

The operator uses the card schematics and assembly drawing for assistance while analyzing a rejected card. To locate the faulty component, the operator must trace the signal through the circuit by probing the land pattern on the back of the card. After the faulty component is replaced, the card must be retested.

For this type of tester operation, the set up time required for a particular card type is about 3 minutes. The actual testing time will average about 100 cards per hour. Faulty cards can be analyzed at about 10 cards per hour.

Although the above tester operation will be typical for Class IV type cards, as special situations occur, more different types of test equipment will be developed. These situations will arise as a result of a factor such as high quantities of cards within a specific card type.

FLOWCHART - CARD TEST AREA

The following diagram (Figure 2) provides a concise picture of card flow within the card test area. All cards enter the computer controlled test system for at least shorts test and possibly some impedance tests. Card Classes I, II, and III are usually completely testable on the system; the acceptable cards going to stock and the non-acceptable cards, to the rework area. Card classes IV, V, VI, and VIII may be ejected from the system and and routed to off-line (Class IV) test equipment for further testing. All repaired cards from the rework area are returned to the input of the computer-controlled test system for retest.

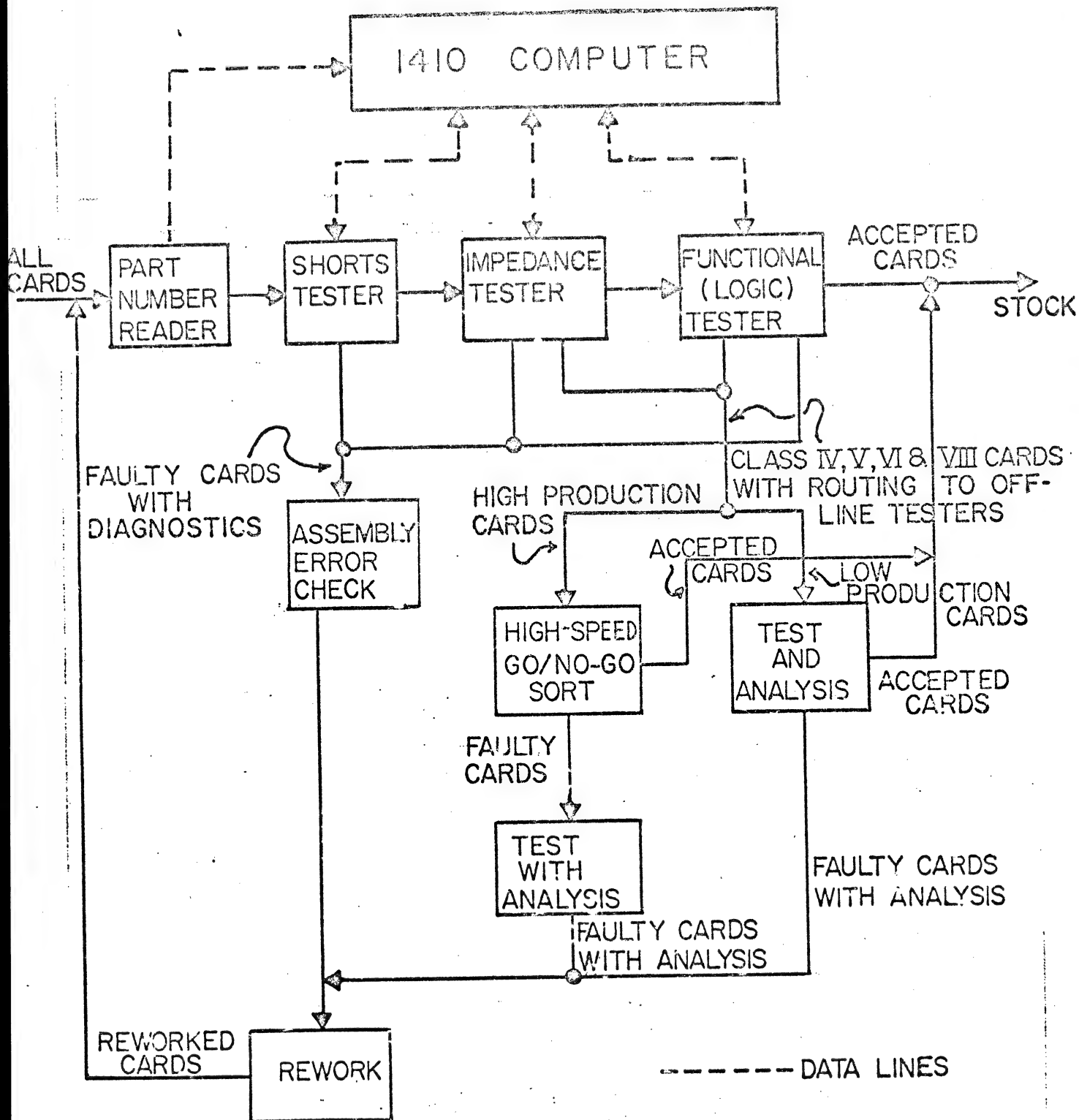



Figure 2. CARD FLOW THROUGH TEST AND REWORK AREA

SCOPE

This suffix defines the control desk, ground rule coordinator, and CCUF functions and gives a listing of individuals responsible for these functions.

Available card and circuit flyer listings are also contained in this suffix.

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ENGINEERING LIAISON REPRESENTATIVES

The following table lists those individuals having responsibilities for implementing the Central Control Desk, Ground Rule Coordinator and Component Control Usage File Functions.

Engineering Liaison Representatives			
Location	Central Control Desk	FUNCTION Ground Rule Coordinator	Component Control Usage File Liaison
Austin	D. Newman 557 X6150	D. J. Canty 543/003 X6174	F. J. Gregory 557
Boca Raton	D. Carver X2698	H. VandenHaak 726/210	S. A. Strickland 726
Boulder	J. C. Penland 214/910 X5515	J. C. Penland 214/910 X5515	G. Mann 214
Burlington	J. Alden X2504		F. W. Spence 356
Endicott	L. Nemeth 167 X4257	R. Hess * 146/676 X1361	D. Petranick 374 X4267
England (Hursley)	A. Buli 640 X2064	A. E. Lovegrove 305	W. L. Clayton 306
France (La Gaude)	H. Lalo 862	H. Lalo 862	H. Lalo 862
France (Essones)	O. Langlois-Berthelot 198	O. Langlois-Berthelot 198	
Gaithersburg	B. Callender EL3 X7576	R. C. Powell EE8/2E-44 X7585	
Germany (Boeblingen)	B. Weiss 146/676 X1362	W. Deptulski 776	H. Lang 783

* Corporate Function

ENGINEERING LIAISON REPRESENTATIVES

Location	Central Control Desk	Ground Rule Coordinator	Component Control Usage File Liaison
Huntsville	R. Hayes F52 X2264	R. K. Rose K27/5-2	
Kingston	S. Maccaline 680/003 X2360	R. E. Racicot 680/003 X6788	S. Maccaline 680/003 X2360
Lexington	P. Wheeler 564 X3452	D. Shattuck 523	S. Ratliff 586
Netherlands	C.Th.Steenstra	C.Th.Steenstra	C.Th.Steenstra
Poughkeepsie	C. McCarthy B39/918 X58324	C. Close C22/918	E. L. Keto B35
Raleigh	J. Finch 735/051-64 X5620	W. Behringer 735/051-64	B. C. Tullis 735/051-64
Rochester	T. Teal 236 X1140	L.E. Krueger 501/020-2 X6513	R. K. Bee 238/020
San Jose	B. Decker 541/013 X3938	Ted Head H75/060	G. Maier 554
Sweden	H. G. Wangberg	L. Borgh	V. Gjerstadt

PURPOSE

Provide all laboratories with the status of each of their cards during the Endicott Engineering Release processing function.

RESPONSIBILITIES

Local Control Desk: A local representative for this function is listed on the "Engineering Liaison Representatives" chart. This local representative will receive card release process information from Department 308, Endicott and disseminate it for local requirements. The local central control desk representatives are listed on the Engineering Liaison Representatives chart in Section 1 of this suffix.

DEFINITIONS OR FUNCTIONS

SCAR - Small Card Activity Report. The program provides listings of weekly and daily card releases through Dept. 308, Endicott.

Dept. 739 - Process Technology Systems Control. EDT printout responsibility.

Dept. 447 - Production Engineering Change Services - Check change and prepare for entry into Express verification.

Dept. 601 - Blueprint Services. Make multilith mats. Has file control on all released drawings. Provides prints for "boots."

Dept. 503 - Process Technical Production Control. Control orders on Endicott floor and manipulation of stock.

Dept. 446 - Engineering Record Maintenance Microfilming area. Duplicate aperture cards.

DEPARTMENT 308 - ENDICOTT

The following is done by the SCAR Program: A complete status report of all cards in process, sent by the individual location, will be published each day.

THE COMPLETE LISTING

The complete listing shows the status of cards as of the previous day at 4 p.m., and includes the following information:

a. Cards active in Department 308.

THE COMPLETE LISTING (continued)

b. Cards on hold in Dept. 308.
c. Cards incomplete in Dept. 308 and incomplete code.
(See incomplete code listing).
d. Cards in 739.
e. Cards in 447.
f. Cards in 601.
g. Cards in 503.

THE DAILY LISTING

The daily listing shows cards already released in the week and cards added to the complete listing reflecting activity for the previous day.

Listed on the daily listings is:

a. Cards processed by Dept. 308 (cards sent to Engineering Change Services, Dept. 447, from Dept. 308.)

b. Cards for which tapes have been received by Dept. 739.

These two categories indicate activity of the previous day up to 4 p.m.

All reports are transmitted by SCAR on Data Link II. This includes Domestic and World Trade. All locations without data link must notify Dept. 308 This will enable those locations to receive reports by Telex.

INCOMPLETE CODE LISTING

CODE	REASON
AB	ALD Missing
DB	EDT Missing
EB	Schematic Missing
FB	Work Request Missing
CB	Cews Missing
HB	Work inst. Missing
JB	LMT/LTD Missing
KE	Ckt. Flyer Missing
LB	Specification Missing

PURPOSE

Provide a controlled SLT card ground rule gathering and disseminating system between Engineering Laboratories and Card Manufacturing. Request for clarification alterations, etc. are coordinated through a local representative to a central group. The central group coordinates all request for updates deviations, etc. with other corporate Engineering requirements and the manufacturing facility. A listing of the Ground Rule Coordinators is found on the Engineering Liaison Representatives Chart in Section 1 of this Suffix.

RESPONSIBILITIES

Local Ground Rule Coordinator -

The responsibilities of the local ground rule coordinator herein defined are the requirements for interfacing with the Divisional Practice for Ground Rule maintenance and distribution. Additional requirements and specific internal operation procedures may be assigned by the local area. (See Flowchart)

a. Receive all local inquiries and request for deviation or update.

b. Provide interpretation assistance and answer all questions from local information when possible.

c. Insure that all request for deviation or changes to the card ground rules are documented and sent to the corporate ground rules coordinator. When immediate action is required, communication to the corporate coordinator can be made by phone with documentation follow up. Where applicable, as determined by agreement between the local and corporate coordinator, request for deviation or update must be specific i.e. a copy of the effected ground rule section marked to show information to be deleted and/or added.

d. Notify Department 146 Endicott of additions or deletions required for local distribution. Distribution of ground rules will be made to individuals in all areas by Endicott. For distribution it is necessary to indicate the name of the recipient, his address, and the number of copies.

e. The local coordinator will receive a copy of each ground rule revision (direct from Department 146) for review before publishing. Local coordinators are asked to review the copy as soon as possible and return their comments to Department 146 to prevent delay of publishing.

f. The local coordinator will, by his knowledge of local requirements, become extremely useful in determining future ground rule requirements. It is therefore recommended that he maintain a file of local inquiries.

g. Maintain a file of all ground rules.

<u>Corporate Card Ground Rule Coordinator</u> -

The corporate ground rule coordinator is responsible for merging manufacturing and Engineering requirements into rules that will be acceptable to both areas.

Interface procedures between the corporate coordinator and manufacturing will be determined by the specific problem to be resolved.

Interface procedures between the corporate coordinator and other Engineering areas will be as follows:

a. Receive all inquiries from local ground rule coordinators.

b. Obtain answers to all inquiries from existing information and/or by appropriate investigation. When an immediate answer is available an estimated date of completion and a procedure for investigation will be established. This information will be forwarded to the originating local coordinator. If an immediate answer is required, usually due to a pending card release, it may be possible to obtain a one time deviation approval for the specific card.

c. Obtain deviation approvals. The steps required for obtaining a deviation approval will be dependent on the specific deviation requested. It will be the responsibility of the corporate ground rule coordinator to obtain the necessary agreements and approvals to assure the acceptability of deviation received. The corporate ground rule coordinator will assist, when necessary, in assuring that documents etc. are processed through the system with minimum delay when a deviation has been obtained prior to the actual processing of the document affected.

d. Determine if a ground rule update is required. Example: In some cases a one time deviation will suffice and no ground rule update is required.

e. Insure that ground rules revision commitments are met, the necessary approvals are obtained and distribution is made.

f. Coordinate ground rules update activity by insuring that procedures in the rules are correlated for compatible timing and input output activity.

g. Maintain a master file of all ground rules.

GROUND RULES COORDINATION FUNCTION FLOW CHART

LOCAL INPUT
MACH. GRPS, ETC.

INQUIRES FROM LOCAL AREA

LOCAL GROUND
RULE CO-ORDINATOR

ANALYZE

CAN IMMEDIATE ANSWER BE GIVEN ?

YES

NO

INTERFACE WITH LOCAL GROUPS AS REQUIRED

MAINTAIN LOCAL DISTRIBUTION ROSTER SEND ADDITIONS AND DELETIONS TO DEPT. 146 ENDICOTT

A

IF REQUEST FOR GROUND RULE ALTERATION OR DEVIATION INSURE THAT DOCUMENTATION EXISTS

CORPORATE GROUND
RULE CO-ORDINATOR

ANALYZE

ESTABLISH INVESTIGATION PROCEDURE REQUIRED - GIVE ESTIMATED DATE OF COMPLETION

NO

CAN IMMEDIATE ANSWER BE GIVEN ?

YES

OR

DETAILED INVESTIGATION INSURE THAT APPROPRIATE GROUND RULE IS WRITTEN, APPROVALS OBTAINED, ETC.

IF EMERGENCY OBTAIN NECESSARY AGREEMENT FOR DEVIATION APPROVAL IF POSSIBLE.

NOTIFY REQUESTOR PHONE, TELEX ETC.

A

DEPT. 146 ENDICOTT MAINTAIN CORPORATION DISTRIBUTION ROSTER

DETERMINE IF GROUND RULE UPDATE IS REQUIRED

TYPE ADDITION OR REVISION AND REPRODUCE.

SEND MASTER TO REPRODUCTION SERVICES

SEND REPRODUCTION TO EACH LOCAL GROUND RULE CO-ORDINATOR

DUPLICATE AND DISTRIBUTE ACCORDING TO ROSTER PROVIDED BY DEPT. 146 END.

CORPORATE DISTRIBUTION TO INDIVIDUALS

PURPOSE

To provide a machine manager the assurance that components selected for use in his machine are technically sound and available in the quantities required.

To provide, in one central location, a corporate file which is capable of tracing the usage of a CD electronic part from the lowest component level to the feature level for all development machines in the corporation.

RESPONSIBILITIES

Local Representative at Each Plant

Provide CCUF with a profile of all components and cards used in a machine six months prior to announcement. Information to be obtained from the machine B/M.

Update the CCUF, as required regarding subsequent changes to card requirements.

a. New card part number selected for use for the first time.

b. Any change in quantity of a presently used card (increase or decrease).

c. Provide quantities of each card by feature and/or machine for "a" and "b".

Maintain a liaison between the machine manager and CCUF concerning pending engineering changes, cancellations of projects, etc.

Card Layout Department at Each Plant

Submit to CCUF a list of all components required for a new card being designed.

Submit to CCUF all changes to previously related cards.

Provide the quantity of cards required for each feature and/or machine for 1 and 2 above.

FUNCTION

The Function of CCUF (Dept. 375, East Fishkill)

Process all requests to assure technical feasibility and component availability of parts (within three working days).

Update CCUF for all approved users.

Provide, on a daily basis, a where used on any component or card up to the machine development level.

Provide, on a daily basis, a machine explosion of all cards and components used within a development machine and/or feature.

Provide, on a monthly basis, an explosion of all development machines contained in the file to show quantities of cards and components used.

Provide, on a monthly basis, a list of "Critical Components" so they can be avoided in new design.

DESCRIPTION

This Section contains descriptive and distribution information on available card and circuit flyer listings. These lists contain information on all cards and circuit flyers available in the SLT system.

Card Cross Reference Listings-

Small Card Cross Reference Lists are computer Generated from the LMT System.

a. Card usage by part number lists all card part numbers on LMT in numerical order. Data covered includes Category Code, Control Code, Status, Title, Size, Engineering Change Number, and Circuit Flyer Usage.

b. Card usage by category code lists the same data as above list sorted on category code.

c. Circuit flyer where used listing is sorted by Circuit flyer and gives last four digits of card part numbers on which each Circuit Flyer appears.

d. Card duplication check list is sorted by Circuit flyer usage, lists card part numbers and Circuit flyers and no. of times each one is used per card. Also contains control codes.

CARD USAGE BY CATEGORY CODE EXAMPLE:

```
CAT PT.NO  CC   STATUS      TITLE                          SIZE  E.C.

S15*4171 PD    EXP RES  RELAY DRIVERS                      2-24  4171A
            S15AR 8      T03AF 8

S15*4254 SD        RES 1.0 AMP DRIVER                      2-24 162861
            S15SM 3

S15*4255 SD    SPE OBS 2.5 AMP DRIVER =1                   2-24  162861
            S15SN 2

S15*4256 SD    SPE OBS 0.5 AMP DRIVER                      2-24  162861
            S15SO 8

S15*4260 SD        ACT 1 AMP PNP DRIVER                    2-24 162861
            S15SL 3

S15*4261 SD        ACT 2.5 AMP DRIVER II                   2-24 162861
            S15SP 1      S61SK 2
```

LIST B2
CARD USAGE BY PART NUMBER

CAT	PT.NO	CC	STATUS	TITLE	SIZE	E.C.
T03	*0000	ED	STD	RES 2-3WAY+4-2WAY AND INVERT T03AB 6	1-6	160015
	*0001		*	RES 2-3WAY+4-2WAY AND POWER INVERT T03AG 6	1-6	DEV.XXX
T03	*0002	ED	STD	ACT 5-3WAY AND INVERT T03AB 5	1-6	160016
T03	*0003	ED	*	ACT 5-3WAY AND POWER INVERT T03AG 5	1-6	DEV1695
T03	*0004	ED	STD	RES 2-7WAY+1-3WAY AND INVERT T03AB 3	1-6	160020

LIST A
CIRCUIT FLYER WHERE USED

ID. NO.	CARD PART NO.								
*T61AA	0029	0030	0229	0455	0466	0519	0543	0544	1380
	3287	3320	3349	3366	3390	3401	3409	3425	3530
	3801	3956	4003	4063	4453	4616	4627	4637	4674
	6087	6134	6135	6204	8032	P059	S057	S068	S070
*T61AB	0099	0257	3814	4189	4242	4274	4367	4452	4536
	4810	4814	4815	4896	4909	4910	4911	6133	6140
*T61AC	0346	0347	0705	3020	3021	3035	3038	3175	3761
	4687	5021	5023	8045	M255	S065	S075	S092	
*T61AD	0201	0436							
*T61AF	0012								
*T61AJ	0438	0525	0612	1109	1113	1118	1120	1294	3832

LIST C
CARD DUPLICATION LIST EXAMPLE

CC	SIZE	PT.NO	I.D.	T.U.	I.D.	T.U.	I.D.	T.U.	I.D.	T.U.
SD	2-24	*6235	S03AJ	20	S05AH	3	S05AC	1	S61SB	1
			T03AC	8	T03AD	1	T03AE	1	T03AJ	1
			T20SC	10	T60SE	2				
SD	2-24	*4622	S03AJ	10	S05AH	5	S05AS	1	S61SB	2
			T03AI	2	T20SB	10	T20SC	5	T60SE	1
SD	2-24	*6205	S03AJ	22	S05AH	2	S05AS	2	T03AA	1
			T20SB	20	T20SC	10				
RO	2-24	*4696	S03AJ	8	S05AH	2	S60AU	4	S61IO	4
			T05AB	2	T20AY	4	T20SB	8	T20SC	4
SD	2-24	*4609	S03AJ	6	S05AH	4	S61SB	4	T03AA	2
			T03AD	3	T03SI	2	T15AA	2	T20SB	12
SD	2-24	*4623	S03AJ	9	S05AH	2	S61SB	2	T03AA	1
			T03AE	4	T03TE	1	T20SB	8	T20SC	4

CRCUIT FLYER TITLE / SPEC LIST EXAMPLE:

BLOCK	STATUS	LEVEL	CC	TITLE	SPEC	SPEC
S63SE	STDACT	164186	SD	2 POINT REED RELAY	872825	
S63SF	STDACT	163418	SD	4 POINT REED DELAY	872826	
S63SG	STDRES	161427	SD	1-POINT REED RELAY	872762	
S63SH	STDACT	164186	SD	4 POINT REED RELAY	872766	
S63SK	STDRES	164761	SD	1-POINT 48V REED RELAY	874564	
S65EA	SPLRES	165257	ED	AMPLIFIER-DETECTOR	874210	874222
S65EB	SPLRES	163339	ED	AMPLIFIER DETECTOR	874210	
S65ED	SPLRES	163339	ED	MODEM DRIVER-RECEIVER	874208	
S65EI	SPLRES	163891	ED	TIME DELAY-OR-AND	874205	
S65EK	SPLRES	163339	ED	DISCRIMINATOR-TERMINATOR	874207	
T03AA	STDRES	750762	PC	AND INVERT NO LOAD	873020	890971
T03AB	STDRES	750656	PC	AND INVERT-750 OHM LOAD	872030	873021
T03AB	STDRES	750656	PC		874077	
T03AC					872213	873403
T03AC	STDRES	750762	PC	AND	890973	873449

DISTRIBUTION OF LISTINGS

Circuit Flyer Listing Distribution -

These lists are distributed by Department 147, Endicott once a month. All Circuit Technology and Records Areas receive these lists.

Small Card Cross Reference Listings -

These lists are distributed on both magnetic tapes and hard copy. Hard copy is distributed to Endicott Records and Circuit Technology and all other areas not serviced by a Design Automation or liaison area.

Design Automation areas in the following locations receive a magnetic tape once a month. These tapes can be printed out on a 1401 computer to provide listings to the local records and Circuit Technology areas.

- Boulder, Colorado
- British Lab.
- French Lab.
- Gathersburg, Maryland
- German Lab.
- Kingston Lab.
- Netherlands
- Owego, New York
- Fishkill, New York
- Rochester, Minnesota
- San Jose, California

DESCRIPTION

The Information Source List provide the names of various individuals who may be contacted for information on various subjects related to SLT Card Processing.

INFORMATION SOURCE LIST

TOPIC	PERSON	DEPT.	EXT.	LOCATION
Ground Rule Card ALD	D. Bozon	250	1358	Endicott
Ground Rule Ckt. Flyer	K. Parese	707	4826	E. Fishkill
Card Layout (Component information)	N. Jones	307	1356	Endicott
Ground Rule CCDA Input	R. J. Bucher	167	4257	Endicott
Ground Rule Cable Card	F. Webster	167	4257	Endicott
Special Cards & Processing	J.D.Roche	312	1341	Endicott
Mfg. Liaison	W. Shumin	307	1357	Endicott
Mfg. Pre-analysis Test	D. Bozon	250	1358	Endicott
Mfg. Pre-analysis Test	R. Singer	720	7696	Kingston
Mfg. Pre-analysis Test	D. Heuman	557	6150	Austin
Mfg. Pre-analysis Test	L. Carlson	370	31186	Poughkeepsie
Mfg. Pre-analysis Test	D. McInnes	565	2311	Rochester
Mfg. Pre-analysis Test	F. Herrick	760	7544	San Jose
Info. Ckt. & Card Lists General	J. Gillespie	308	1326	Endicott
Ground Rule Internal Plane	F. Webster	167	4257	Endicott

INFORMATION SOURCE LIST

TOPIC	PERSON	DEPT.	EXT.	LOCATION
Change Analyst Procedures-SLT	J. Paukett	147	1364	Endicott
Change Analyst Procedures-MST	N. Engalnd	147	1364	Endicott
Release Processing Programming	J. McLaughlin	743	7041	
Card Layout	L. Nemeth	167	4257	Endicott
Records Procedures P/N-EC No. Assignment	R. Schlauder	147	1679	Endicott
Accounting, Records History Files Distribution Lists	J. Burke	308	1368	Endicott
Washout	R. Schlauder	147	1679	Endicott
Mfg. Test Interface Distribution	E. Jackson	250	5414	Endicott
Mfg. Pre-analysis Build	E. Cerych	755	2481	Kingston
Mfg. Pre-analysis Build	A. Roberts	769	4337	San Jose
Mfg. Pre analysis Build	D. McInnes	565	2311	Rochester
Mfg. Pre-analysis Build	L. Carlson	370	31186	Poughkeepsie
Mfg. Pre-analysis Build (Endicott)	S. Kimball	259	3484	Owego
Mfg. Pre-analysis Build	W. Clayton	443	Hursley	England
Mfg. Pre-analysis Build	A. Van Leeuwen		Uithoorn	Netherlands
SMT	H. Wintersteen	455	2664	Endicott
Monolithic Memories	J. D. Roche	312	1341	Endicott
Bulk Memories	A. Campbell	565	2424	Endicott